Discrepancies between case evidence and the outcome of coronial decisions in investigations of equivocal death

by

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Originality Declaration, Authority of Access and Statement of Ethical Conduct

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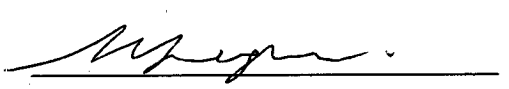

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Abstract

One hundred and nine closed files from an undisclosed state within Australia were selected by searching the National Coronial Information System (NCIS) for cases of deaths from 'unnatural' causes. The final sample included cases where the final determination was suicide (n=29), accident (n=36), homicide (n=22), and undetermined (n=22). Each file was reviewed to identify the presence or absence of pre-determined demographic and evidentiary variables, based on those factors known to be associated with manner of death determinations. Binary logistic regression and classification and regression trees were used to identify significant predictor variables, and formulate decision making models for each manner of death outcome type. Based on the optimal classification tree models for each manner of death determination type, individual cases where coroners' determinations did not match the statistically predicted outcome were identified as representing evidence/determination discrepancies. It was hypothesised that an active cause of death (e.g., asphyxia), adult deaths (>18 years), having a formal history of mental illness, and the presence of a suicide note will predict suicide manner of death determinations. A passive cause of death (e.g., substance related), child-deaths (<18 years), absence of a history of mental illness and no suicide note will significantly predict accidental death and undetermined manner of death determinations. It was also expected that the police hypothesis of the manner of death will significantly predict each respective manner of death outcome (e.g., a police hypothesis of suicide would significantly predict a coronial determination of suicide). Secondly, it was hypothesised that there would be a less than 100% match between coroners' predicted determinations in cases of equivocal death and the observed determination (e.g., some cases observed to an accidental death will be predicted to be a suicide by

the classification tree model). Due to their relatively unequivocal nature, no discrepancies between predicted and observed outcomes were expected in cases of homicide. The results found that asphyxia related deaths, presence of a suicide note, a negative mood state (or stressors) prior to death, and a police hypothesis of suicide, were predictors of suicide determinations. The predictors of accident determinations included the absence of a negative mood state (or stressors) prior to death, and the absence of a police hypothesis of homicide. The logistic regression analysis also found that substance related deaths significantly predicted accident determinations, but this was not replicated by the classification tree model. A police hypothesis of homicide also significantly predicted determinations of homicide. Against what was hypothesised, age and a history of mental illness were not significant predictors for any manner of death determination type. However, as expected, there were overall discrepancies between the observed manner of death determinations and what was statistically predicted. It was concluded that a more standardised approach is necessary to reduce coroner's susceptibility to making inconsistent decisions.

Table of Contents

Originality Declaration, Authority of Access and Statement of Ethical Conduct		ii
Acknowledgements		iii
Abstract		iv
Table of Contents		vi
List of Tables		x
List of Figures		xiii
Chapter 1.	**Overview of the current thesis**	1
Chapter 2.	**The Coroner**	4
2.1	Cause of death *vs* manner of death	4
2.2	The investigation	5
Chapter 3.	**Equivocal deaths**	7
3.1	Drug related deaths	7
3.2	Drowning	9
3.3	Autoerotic asphyxia	10
3.4	Single vehicle deaths	10
3.5	Apparent 'unequivocal' deaths	11
Chapter 4.	**Variability in Coroners' Decisions**	13
Chapter 5.	**Sources of variability:**	17
	Professional and Procedural differences	
5.1	Differences in decision-making procedures between jurisdictions	17
5.2	A legal vs clinical decision	18
5.3	Differences in definitions and recording procedures	20
5.4	Training and experience levels of coroners	23
5.5	Consistency with other professionals	25

Chapter 6.	**Sources of Variability:**	28
	Social Pressures, Beliefs and Biases	
6.1	Child suicide	28
6.2	Culture and race	34
6.3	Religion	38
6.4	Social stigma	39
Chapter 7.	**Sources of Variability: Decision-Making Theories**	43
7.1	Heuristics	43
7.2	Story Model	44
7.3	Confirmation bias	44
7.4	Prototype model	46
Chapter 8.	**Variables that Predict Manner of**	48
	Death Determinations	
8.1	Statistical models	48
8.2	Clinical scenarios	51
8.3	Summary of predictor variables	52
Chapter 9.	**Rationale and Aims of the Current Study**	55
9.1	Summary of the literature and rationale	55
	of the current study	
9.2	Aims of the current study	57
Chapter 10.	**Method**	59
10.1	Participants	59
10.2	Procedure	60
10.2.1	Pilot study	60
10.2.2	Main study	60
10.3	Design	61

10.4	Statistical analysis	61
Chapter 11.	**Results**	63
11.1	Logistic regression overview and results	63
11.2	Suicide determinations	66
11.3	Accidental death determinations	68
11.4	Homicide determinations	70
11.5	Undetermined manner of death determinations	72
11.6	Classification tree overview and results	74
11.7	Suicide determinations	76
11.7.1	Suicide classification and regression tree – A	76
11.7.2	Suicide classification and regression tree – B	77
11.7.3	Discrepant cases	79
11.8	Accidental death determinations	83
11.8.1	Accidental death classification and regression tree – A	83
11.8.2	Accidental death classification and regression tree – B	84
11.8.3	Discrepant cases	86
11.9	Homicide determinations	94
11.9.1	Homicide classification and regression tree – A	94
11.9.2	Homicide classification and regression tree – B	95
11.9.3	Discrepant case	96
11.10	Undetermined manner of death determinations	97
11.10.1	Undetermined classification and regression tree – A	97
11.11	Summary of predictor variables of manner of death determinations	97
11.12	Summary of statistically predicted outcomes *vs* observed outcomes	99

Chapter 12.	**General Discussion and Conclusion**	101
12.1	General Discussion	101
12.2	Implications: towards a more standardised process of decision-making	112
12.3	Limitations and future research	118
12.4	Conclusion	121
References		122
Appendix		147

List of Tables

Table 1. *Descriptive statistics of variables according to manner of death determination* 64

Table 2. *Variables which make a significant contribution to coroner's manner of death determinations of suicide based on significant Roa's efficiency scores* 66

Table 3. *Significant predictor variables included in the logistic regression model for cases predicted to be suicide* 67

Table 4. *Variables which make a significant contribution to coroner's manner of death determinations of an accidental death based on significant Roa's efficiency scores* 68

Table 5. *Significant predictor variables included in the logistic regression model for cases predicted to be an accidental death* 70

Table 6. *Variables which make a significant contribution to coroner's manner of death determinations of a homicide based on significant Roa's efficiency scores* 71

Table 7. *Significant predictor variables included in the logistic regression model for cases predicted to be a homicide* 72

Table 8. *Variables which made a significant contribution to coroner's manner of death decisions remaining undetermined based on significant Roa's efficiency scores* 72

Table 9. *Significant predictor variables included in the logistic regression model for cases predicted to be undetermined* 73

Table 10. *Cost complexity measures of the C&RT for predicting*

a coroners' determination of suicide (all variables) 76

Table 11. *Classification table for suicide determinations (all variables) based on the optimal tree* 77

Table 12. *Cost complexity measures of the C&RT predicting a coroners' determination of suicide (all variables, excluding police hypotheses)* 78

Table 13. *Classification table for suicide determinations (all variables, excluding police hypotheses) based on the optimal tree.* 79

Table 14. *Cost complexity measures of the C&RT predicting a coroners' determination of accidental death (all variables)* 83

Table 15. *Classification table for accidental death determinations (all variables) based on the optimal tree* 84

Table 16. *Cost complexity measures of the C&RT predicting a coroners' determination of accidental death (all variables, excluding police hypotheses)* 85

Table 17. *Classification table for accidental death determinations (all variables, excluding police hypotheses) based on the optimal tree* 86

Table 18. *Cost complexity measures of the C&RT predicting a coroners' determination of homicide (all variables)* 94

Table 19. *Classification table for homicide determinations (all variables) based on the optimal tree* 95

Table 20. *Cost complexity measures of the C&RT predicting a coroners' determination of homicide (all variables,*

excluding police hypotheses) 96

Table 22. *Cost complexity measures of the C&RT predicting a coroners' determination of undetermined (all variables)* 97

List of Figures

Figure 1. *Classification tree for predicted for coroner manner of death for suicide determinations: all variables* 77

Figure 2. *Classification tree for predicted for coroner manner of death for suicide determinations: all variables, excluding police hypotheses* 78

Figure 3. *Classification tree for predicted for coroner manner of death for accident determinations: all variables* 84

Figure 4. *Classification tree for predicted for coroner manner of death for accident determinations: all variables, excluding police hypotheses* 85

Figure 5. *Classification tree for predicted for coroner manner of death for homicide determinations: all variables* 95

Chapter 1. Overview of the current thesis

There is a large body of literature that has discussed the apparent variability and inconsistencies present in manner of death determinations. In particular, there is widespread concern that suicide determinations are underestimated in official rates due to the inconsistencies in decisions by coroners and other death certifiers. There have been a number of empirical studies that have investigated coronial decision making, but few studies have been done in the context of the Australian coronial system. Furthermore, of those studies that have utilised statistical modelling to investigate coronial decision making, most have not used these models as the basis for identifying and then examining 'discrepant' cases. In addition, there is little to no literature that has examined the consistencies between coroner's determinations, and the hypotheses of other professionals, such as investigating police officers, or pathologists.

Thus, the aim of the current study is to use an exploratory approach to firstly identify the main predictor variables in coronial manner of death determinations, and secondly, use these predictor variables to develop statistical models for each manner of death type (suicide / accident / homicide / undetermined). The development of these models is intended to provide insight into the decision making processes of the coroner and to identify which variables are considered the most important when making manner of death determinations. The current study also aims to use the results of these models to determine whether statistically predicted outcomes match observed outcomes, and if not, which cases are considered 'discrepant' based on the variables present in each case. In other words, to identify cases where the coroner's determination did not match the determination predicted by the statistical models.

The current study includes a review of the relevant literature. The aim of this literature review is to provide a comprehensive examination of the issues related to

coronial decision making, including research that suggests that there is variability in death certification, as well some of the factors that are commonly cited as contributing towards this variability. These factors include difficult cases (i.e., equivocal deaths), differences in certification and investigative procedures, variability among officials and systems, inadequate training or clinical knowledge, and lack of standardised definitions and decision-making criteria. Furthermore, variability is thought to arise from factors outside of the investigative process, including cultural, social and familial pressures, and psychological processes such as biases and heuristics. In an effort to understand what factors coroners (and other death certifying authorities) consider to be the most important in their decision-making processes, the current study also aims to outline the variables that have been found to best differentiate between manner of death determinations.

The literature review begins with a brief overview of the role of the coroner and the important implications their decisions, and the difference between the terms 'cause' and 'manner' of death (Chapter 2). The term 'equivocal death' is then explained, and examples provided, including drug related deaths, single vehicle fatalities, autoerotic asphyxia and drowning (Chapter 3). The review then examines the research that suggests that decisions amongst manner of death certifiers can be variable and inconsistent, and that some manner of death outcomes (e.g., suicide) are underreported (Chapter 4). Subsequent chapters review the sources of this variability, including professional and procedural differences (Chapter 5), social pressures, beliefs and biases (Chapter 6), and psychological processes and decision-making theories (Chapter 7). Finally, the literature review examines the variables that predict manner of death determinations, according to statistical modelling of actual decisions, and experimental approaches using clinical scenarios and questionnaires (Chapter 8). Following a discussion of the relevant literature, the rationale, aims and

hypotheses of the current study are outlined (Chapter 9), followed by the method section (Chapter 10) which describes how these hypotheses are investigated. The results of this study are then presented in two sections based on the statistical analysis used, with subsections discussing the results for each manner of death determination type: suicide; accidental death; homicide; and undermined (Chapter 11). Firstly, the exploration of the data using logistic regression analysis is presented. This is followed by results from the classification and regression trees, including a description of the cases identified as 'discrepant', whereby the coronial manner of death determination is not consistent with the determination predicted by the statistical models. Finally, a general discussion of the results, limitations of the research, implications of the findings, and conclusions is presented in Chapter 12.

Chapter 2. The Coroner

In most jurisdictions it is the coroner who has the legal responsibility to investigate deaths classified as 'reportable', which can be defined as unexpected, violent, unusual, suspicious or unnatural (Freckelton, 2005). In more recent times, coroners have also been required to preside over deaths which occur in institutions, including prisons and aged car facilities (Carpenter et al., 2008). The procedure for making this decision can vary across different jurisdictions, as can the decision maker's educational and professional background, and their personal religious and moral beliefs (Robertson & Crawley, 2009). Across the world, a coroner can range in professions from lawyers, medical doctors, police officers, through to lay persons (Robertson & Crawley, 2009). Within Australian jurisdictions, any magistrate can act as a coroner.

The main task of the coroner is to ascertain by what means and circumstances a person died. They also have considerable power to investigate and make findings as to what gave rise to a death, and whether any negligence or defect in care contributed to the death (Freckelton, 2005). Coroners are also able to make recommendations or comments about a particular type of death. Thus, there is a potential as a public health official to discern patterns and trends on particular categories of death, and to make recommendations to reduce the incidence of avoidable deaths in the future (Freckelton, 2005). Examples of this could include suicide prevention, road safety, and the responsible administration of prescription medicines.

2.1 Cause of death vs manner of death

Cause of death refers to the method, mechanism, or modality that directly led to a person's death (Lacks, Westveer, Dibble & Clemente, 2008). Examples include gunshot, drug intoxication, blunt trauma or asphyxia. In most coronial systems, this

determination is made following an autopsy of the body. In more recent years, death investigation processes are becoming more flexible and moving on from the traditional body dissection, and are including methods such as biopsy histology, toxicology and radiological examinations, such as CT scans (Freckelton & Ranson, 2006). Indeed, medical imaging is becoming so refined that some argue physical autopsies will soon be obsolete (Timmermans, 2006).

Manner of death refers to the classification of the type of death. Lacks et al. (2008, p. 151) describe manner of death as the "moving force responsible for death". A manner of death classification is typically one of four modalities, represented by the acronym NASH: natural, accident, suicide or homicide. When the circumstances of a death do not allow the decision maker to confidently make a determination in one of these four categories, the death is classified as undetermined (which is also referred to as 'open'). Ebert (1987) suggests that manner of death can be distinguished from cause of death, because it identifies intent of the deceased. For example, if a person died from a gunshot wound, the medical examiner or coroner would need to decide if the decedent pulled the trigger to take their own life (suicide), if the gun fired accidentally (accidental death), or if another person was responsible for the death (homicide).

2.2 The investigation

A coroner generally reaches a decision following a post mortem and an investigation where relevant data pertaining to the cause of death is collected and examined (Stanistreet, Taylor, Jeffrey & Gabbay, 2001). In order to gain this information, a coroner must work closely with a number of other professionals, including the police, who visit the scene of the death and gather information, and the pathologist and other medical personnel, who perform autopsies and other medical procedures on the deceased (Carpenter et al., 2008). Within some jurisdictions (e.g., the

Australian state of Queensland), the legislation deems that the coroner is responsible for determining the level of invasiveness of the autopsy, and must consider a family's concerns about an autopsy (Carpenter et al., 2009). In addition to forensic and pathology evidence, the coroner also frequently considers the psychological and behavioural history of the deceased, and statements from friends and relatives.

To ensure that the coroner accurately reaches a decision on the manner of death of the deceased, it is important that all avenues of investigation are explored. Some causes of death can have a number of reasonable explanations, making it particularly challenging to classify the death. For example, firearms are a common method used in the commission of both suicide and homicide, and therefore both explanations need to be taken into account during a shooting investigation. Similarly, in drug overdose cases, the manner of death is commonly classified as suicide, accident, or undetermined. As Lacks et al. (2008) argue, when a body is found at a crime scene, investigators must always conduct a thorough death investigation and allow the evidence to prove homicide, suicide or accidental death. For example, if an investigator holds a preconceived assumption that a particular type of death always equals homicide, they might utilise a large number of resources identifying potential suspects and possible motives, without examining other forensic evidence, gathering statements from family members and exploring potential risk factors, which may have pointed to an alternative manner of death, such as suicide (Lacks et al., 2008). Deaths where a number of possible manner of death explanations may apply are termed equivocal deaths and these deaths form the basis of this project.

Chapter 3. Equivocal Deaths

An equivocal death is any death where there is an uncertainty as to the surrounding circumstances of the death, creating relatively equal probability of two or more possible manner of death classifications (Lacks et al., 2008). Approximately 5% to 20% of all deaths are judged to be equivocal by medical examiners (Biffl, 1996). It is important to accurately determine manner of death in equivocal cases, because inaccurate manner of death determination may significantly impact on a number of areas including public health records, the deceased's reputation, insurance payments, the pursuit of criminal investigations, and understanding suicide risk factors (Biffl, 1996; Ebert, 1987). Examples of equivocal deaths include drug related deaths, drowning, auto erotic asphyxia, single vehicle deaths, 'suicide by cop' (whereby an individual provokes a law enforcement officer to use lethal force which then results in their death), Russian roulette deaths, self inflicted deaths of psychotic individuals, train overruns, and deaths of children aged between five to ten years (Jobes, Berman & Josselson, 1987; O'Donnell & Farmer, 1995; Scott, Swartz & Warburton, 2006). The literature relating to some of these equivocal deaths will be discussed over the remainder of the chapter.

3.1 Drug related deaths

As Shneidman (1981, p. 326) states, "drug related deaths can be among the most equivocal". It is well established that the mortality rate of drug users is much higher than the general population (Webb et al., 2003). It is therefore very important to maintain accurate and detailed data on drug related deaths in order to monitor changes in drug use and to identify personal factors and practices that could increase risk amongst users (Webb et al., 2003). Drug related deaths pose a unique difficulty to medical examiners and coroners in determining the intent of the death. For example, Donaldson, Larsen, Fullerton-Gleason and Olsen (2006) examined the

characteristics of undetermined, unintentional and suicide poisoning deaths (n = 212) in Utah, including demographic information, death characteristics, forensic toxicology results, mental health history of the deceased, and a number of other potentially contributing factors. Classification and regression tree analysis was used to identify the characteristics that best distinguished suicide from unintentional poisoning deaths, and this analysis was then applied to the undetermined cases. Based on these results, it was estimated that the poisoning suicide rate is underreported by approximately 30%, and unintentional poisoning deaths were underestimated by 61% (Donaldson et al., 2006).

Even with an accurate assessment of the deceased's intent in the moments leading up to their death, an individual may commence suicide actions (through self poisoning or overdose) and then change their mind, only to find it is too late and their action has a fatal outcome (Cantor, McTaggart & De Leo, 2001). Furthermore, due to their illegal nature, some of the additional challenges involved in certifying illicit drug deaths include determining the circumstances around the death, which may be unknown or falsified (e.g., the body may be moved from the scene by persons wishing to avoid involvement) (Shai, 1994).

A study by Cantor et al. (2001) compared data from the Queensland Suicide Register (QSR) with data from the Australian Bureau of Statistics (ABS). Cases were analysed by methods of committing suicide and demographic variables associated with the deceased in order to determine the nature of difficult-to-classify suicides. It was found that opiate overdoses were most difficult to code due to ambiguous circumstantial information and unclear intent on the part of the deceased (Cantor et al. 2001). Similar findings were made by Stanistreet, Gabby and Taylor (2004), who examined 238 male deaths that occurred in 1995 in the Merseyside and Cheshire districts. It was found that drug users of more harmful substances such as opiates and

methadone, were significantly more likely to receive an accidental death determination, rather than a suicide determination. Due to these challenges, it is thought that manner of death in drug related overdoses is often misclassified (typically as accidental deaths).

3.2 Drowning

The incidence of drowning varies among countries, with reported rates ranging between 3% and 26% of the total number of suicides (Salib & Agnew, 2005). Drowning is one of the leading causes of death where the manner of death remains undetermined. In a 25-year review of drowning deaths in Finland, it was reported that drowning was the second leading cause of undetermined deaths, with only 23.9% of deaths being classified as suicide (Lunetta, Smith, Penttila & Sajantila, 2003). Similarly, during a 15 year review of suicide and undetermined deaths in England and Wales, Kelly and Bunting (1998) found that approximately 30% of deaths from drowning were given a suicide determination, with 70% given an undetermined finding. Across Australia in 2008, there were 263 cases in which the cause of death was by drowning or submersion. Of these cases, 159 (60.5%) were classified as accidental death, 45 as intentional self harm (i.e., suicide, 17.1%), and 57 as undetermined intent (21.7%) (Australian Bureau of Statistics; ABS, 2008).

A number of other studies have also found that drowning deaths are underrepresented in overall suicide determinations, and/or overrepresented in undetermined outcomes (e.g., Walsh, Walsh & Whelan, 1975; Neeleman & Wessely, 1997, Cooper & Milroy, 1995; Linsley, Schapira & Kelly, 2001; Stanistreet et al., 2001; Ohberg & Lonnqvist, 1998). As Salib and Agnew (2005) noted, unlike many other methods of suicide, the profile of the typical suicidal drowning victim is only relevant to the location in which the drowning took place, therefore it can be difficult to pinpoint typical risk factors associated with this modality of death.

3.3 Autoerotic asphyxia

Autoerotic asphyxia is a sexual practice where an individual attempts to enhance a sexual experience by inducing cerebral hypoxia (Scott et al., 2006). The diagnosis of this type of death is often accompanied by evidence of masturbation, the presence of pornography and other sexual props, 'safety' devices intended to release the individual from the ligature, and if the death took place in a secure and secluded location (Byard & Botterill, 1998). Autoerotic asphyxia is usually classified as accidental due to the unanticipated failure of the device that was used to induce the asphyxia during sexual arousal. Because this type of death is associated with ligature strangulation and other forms of self harm, there is a potential for the coroner to mistake it for homicide or suicide (Knoll, 2009). Caution also needs to be taken determining cases of adolescent deaths where the youth may have been involved in playing risky games involving self-induced hypoxia in an attempt to gain pleasure or thrill seeking from an altered level of consciousness, e.g., the "choking game" (Byard & Botterill, 1998; Andrew & Fallon, 2007)

3.4 Single vehicle deaths

Road fatalities may also be equivocal deaths, as it is possible that death occurred as the result of the deceased's deliberate actions, be it planned or impulsive. According to Morild (1994), a road traffic death may offer a suicidal individual an opportunity to die in a socially acceptable manner. It is estimated that 1.6% to 5 % of vehicle crash fatalities are suicides (Schmidt, Shaffer, Zlotowitz & Fisher, 1977). However, road fatalities are nearly always classified as accidents (Connolly, Cullen & McTigue, 1995). This suggests that a considerable proportion of vehicular deaths classified as accidents, are in fact concealed suicides. In particular, single-vehicle, single-occupant fatal crashes can be especially suspicious (Schmidt et al, 1977; Peck & Warner, 1995). An early study by Phillips (1977) investigated whether the rate of

motor vehicle deaths increased after cases of suicide were publicised in the media. It was found there was on average the number of motor vehicle fatalities increased by 9.12% in the week after a publicised suicide, and the more publicity given to a story, the greater the number of vehicle deaths thereafter. Phillips suggested that this rise might have occurred due to the stories stimulating a wave of imitative suicides, some of which could have been disguised as motor vehicle accidents.

A later study by Connolly et al. (1995) examined the circumstances of single road traffic deaths in County Mayo, Ireland, to determine if any were disguised as suicides. They found suspicion of suicide in six (4.5%) of the 134 fatalities, but could not find definitive evidence that these deaths were self inflicted. More recently, Murray and De Leo (2007) surveyed 1,196 individuals with a history of suicide ideation and behaviours, and found that of those who planned a suicide, 14.8% (n=61) had conceived to have a motor vehicle "accident" and of all attempters, 8.3% (n=19) had previously attempted via motor vehicle collision. The authors speculate that the motive behind choosing this method are often different to other methods, including financial benefits for family members (e.g., via insurance payouts), and avoiding the stigma often attached to the aftermath of suicide.

3.5 Apparent 'unequivocal' deaths

The above methods of death are in contrast with other causes, including hanging and carbon monoxide poisoning, which are highly consistent with suicide (Australian Institute for Suicide Research and Prevention; AISRP, 2003). For example, in Australia in 2008 the most frequent method of suicide was hanging, used in half (53%) of all reported suicide deaths (ABS, 2008). However, even apparent 'unequivocal' cases may warrant further investigation. An example of this is the well-known case of an apparent suicide of an eight-months pregnant British woman whose body was found hanging in the garage of her home. She was found

accompanied by a suicide note, which in some jurisdictions leads to an automatic certification of suicide (Robertson & Crawley 2009). However, suspicions grew that the woman's husband, Eddie Gilfoyle, had murdered her and disguised the scene to mimic a suicide. A psychological autopsy found that she had not been suicidal prior to her death, but this evidence was not admitted to court because it failed to meet the test of admissibility of expert testimony. However, additional evidence later emerged that Mr Gilfoyle may have 'tricked' his wife into putting her head into the noose, and had actually dictated the suicide note for her to write. Eddie was eventually charged with Mrs Gilfoyle's murder, but the outcome remains contentious (R v Gilfoyle, 2001).

Equivocal deaths pose unique challenges for manner of death certifiers due to difficulties choosing between two or more possible manner of death classifications. As a result, there is a strong likelihood that variability may arise in these classifications.

Chapter 4. Variability in Coroners' Decisions

Because of the important role coroners play in providing data on mortality rates and through making recommendations, it is essential that their findings are accurate and consistent. However, there is a large body of literature that suggests there is considerable variability in manner of death certifications, especially in regards to suicide, which is often misclassified as an accidental death or undetermined. While the true extent of these inaccuracies remains unclear, there have been a number of studies that have attempted to estimate the rate of manner of death misclassification. Holding and Barraclough (1975; 1978) conducted comparative studies of matched cases of suicide, accidental death or undetermined deaths. They found that a high proportion of both accidental and 'undetermined' deaths had the clinical characteristics of suicides, including the deceased being known to be receiving medical treatment for psychological symptoms before death, having a history of psychiatric care, and previous suicide attempts. It was suggested that a large number of the undetermined and accidental deaths may actually be suicides, and that suicides may be underreported by as much as 22% (Holding & Barraclough, 1975).

In another study, Huusko and Hirvonen (1988) reviewed 283 cases of suicide, accidental and undetermined deaths from the province of Oulu in Finland. Of the 125 cases primarily regarded as non-suicides (accidental or undetermined deaths), 24 contained features consistent with a suicidal death. They concluded that the official figure for suicide could be as much as 18.9% lower than the actual number of suicides. Furthermore, Ohberg and Lonnqvist (1998) estimated that approximately 10% of suicides were misclassified as undetermined. Similarly, Donaldson et al. (2006) study into the classification of poisoning deaths in Utah, estimated that overall suicide rates were also underestimated by 10%, while more recently, Chang,

Sterne, Lu and Gunnell's (2010) investigation of death classification in Taiwan, suggested that suicide rates may be underestimated by more than 30%.

There have also been studies into underestimations of suicide figures for specific populations. Hoberman and Garfinkel (1988) used predetermined criteria to review cases of death in individuals 19 years and younger in the Minnesota area. They found 90 cases that the medical examiners had determined to be accidental death, homicide or undetermined were more likely to be suicides, constituting 15% of the total number of youth suicides.

Other studies have compared coroners' findings, official mortality statistics and health records to determine whether inconsistencies exist. In the study by Stanistreet et al. (2004), which examined the impact of drug misuse on a sample of sudden, unexpected, violent or unnatural male deaths, significant differences were found between the proportions of drug related deaths that were identified from coroners' inquest data compared to the proportion of drug related deaths that were identified by the Official National Statistics and the newly proposed European Union Coding System (EMCDDA), with the latter two classification methods coding significantly fewer deaths as drug related (Stanistreet et al., 2004). The authors suggested that these findings support the view that drug related deaths are frequently underestimated and inconsistently reported.

Studies that have utilised clinical scenarios have also found great variability in manner of death decisions across medical examiners and coroners (Jarvis, Boldt & Butt, 1991; Goodin & Hanzlick, 1997; Hanzlick & Goodin, 1995; Roberts, Gorodkin & Benbow, 2000; Parai, Krieger, Tomlinson & Adlaf, 2006). Roberts et al. (2000) distributed 16 clinical scenarios of 'borderline cases' (based on real deaths) to coroners in England and Wales and asked recipients to reach a decision as to the manner of death. It was found that there was considerable variation in the way in

which each coroner approached each case, with near consensus (>80% concordance) in only two of the 16 cases, including five where there was no significant agreement between the coroners and the verdict returned ("natural causes" versus "misadventure/accidental"). Similarly, Goodin and Hanzlick (1995) asked 198 physicians to determine the manner of death in 23 different scenarios. It was found the classification of manner of death was highly variable, especially for the more challenging death scenarios. Agreement amongst participants of 80% or more occurred for only 11 of the 23 scenarios, indicating that there was disagreement over the verdict for a large proportion of the cases.

More recently, Robertson and Crawley (2009) reviewed 29 cases of equivocal death determined by a British coroner to be suicide, accidental death or open (i.e., undetermined) findings. Case variables (including demographic, death scene, pathology and psychiatric information) were analysed using a multidimensional scalogram analysis (MSA) to determine whether statistically predicted determinations matched the observed determinations. Overall, the cases fell within three geometric regions (pooling together the suicides, accidental deaths and open findings), suggesting that the coroner's determinations were made in a largely systematic and consistent manner. However, in seven cases from the 29 cases reviewed there was a mismatch between the coroner's manner of death determination and the statistically determined outcome (i.e., these cases fell within a different MSA region). The authors provided a number of reasons for the cases that were identified as discrepant, including age of the deceased (i.e., if the deceased was a child), highly equivocal deaths (e.g., overdoses), psychiatric history of the deceased, and the coroner's possible considerations to pressure from the family of the deceased to find other than suicide.

The issue of the quality and consistency of manner of death determinations is a complex one. It is unlikely that a single factor can explain all of the variability, and it is more probable that a number of systemic, investigational, psychological, cultural and social factors play a role in influencing coronial decision making processes. Jobes et al. (1987) identified a number of potential sources of variability including differences in investigative procedures, lack of an operational criteria, variability among officials and systems, inadequate training, lack of initial suspicion, family pressure and social stigma, difficult cases (i.e., equivocal deaths), and resistance or biases. Some of these sources of variability in manner of death determinations will be examined in more detailed over the next three chapters.

Chapter 5. Sources of Variability: Professional and Procedural differences

5.1 Differences in decision-making procedures between jurisdictions

While most western countries follow similar processes, there are some differences in death certification procedures depending on the legal jurisdiction under which the death occurred. Some jurisdictions reach manner of death determinations following a coronial investigations and/or public inquest (e.g., Australia and Britain), while other countries (e.g., Germany) allow general practitioners to certify suicide deaths (Cantor, 2000, as cited in AISRP, 2003). Variation can also exist within jurisdictions. For example, in the United States suicides can be certified by a variety of professionals, ranging from a funeral director in small jurisdictions to qualified medical examiners (Moscicki, 1995). In Australia, differences in the coronial legislations between States and Territories result in variation in the official reporting of manner of death determinations. Some states and territories confine their findings to medical as opposed to behavioural descriptions of deaths (Cantor & Neulinger, 2000). Furthermore, only coroners in New South Wales and Western Australia routinely refer to the term 'suicide' in their determinations, while some other jurisdiction never explicitly use the term (Cantor & Neulinger, 2000).

According to De Leo et al. (2010), some Australian coroners may actually be placed under additional legal constraints when it comes to ruling on the intent of the deceased. For example, under the South Australian Coroners Act (2003), in cases that do not go to inquest the coroner is only permitted to determine a deceased's cause of death, not the circumstances surrounding the death. Therefore the state and deputy coroners in South Australia consider that they are forbidden to rule on intent (De Leo et al., 2010). However, other Australian statutes oblige coroners to determine "how" the person died" (Qld, Vic, Tas, WA), the "manner and cause of

death" (NSW, ACT), and "any relevant circumstances concerning death" (NT) (De Leo et al., 2010, p. 454).

5.2 A legal vs clinical decision

One of the concerns about manner of death determinations (especially in regards to suicide) is that the final legal decision may be different from the clinical decision (O'Carroll, 1989). Within Australia, coroners come from a background of legal practice (the magistracy). This is in contrast with medically or medico-legally trained certifiers, such as is those in the USA or Canada (Freckelton, 2007). Such differences in training are likely to be reflected in their evaluation of the evidence, with legally trained certifiers perhaps giving more weight to rigorous hard evidence based decision making and certainties. On the other hand, it has been suggested that medically trained certifiers tend to work more with probabilities, and therefore will have less hesitation in reaching a determination of suicide (Brooke & Atkinson, 1974; Freckelton, 2007). Furthermore, without medical experience, legally qualified certifiers are at the mercy of the other medical experts when it comes to interpreting autopsy findings (Brooke & Atkinson, 1974).

Moreover, in order to reach a determination of suicide it requires a high degree of probability. In the English coronial system, a criminal standard of proof is required. Therefore, before a determination of suicide is reached, a coroner must be satisfied that a deceased person's intent to take their own life was proved beyond a reasonable doubt (Hallentstein, 1990). Under Australian Common Law, there is also a presumption against suicide with all states and territories being inherently conservative in suggesting that deaths were intentionally self-inflicted (Cantor & Neulinger, 2000). The coroner's decision is guided by the fact that the evidentiary standard of proof for a suicide determination is somewhere in between the civil standard, being the balance of probabilities, and the criminal standard. This is

referred to as the Briginshaw Test (Briginshaw v Briginshaw,1938; Milovanovich, 2006). Essentially, Briginshaw requires that the more serious an allegation, the more inherently unlikely an occurrence or the more grave the consequences of a finding, the clearer or more persuasive the evidence must be. Therefore in cases with serious consequences (e.g., suicide), a coroner will not necessarily make a decision on the balance of probabilities, which is used more with clinical judgement and common sense reasoning (O'Donnell & Farmer, 1995). As a result, if there is insufficient evidence to record a suicide determination, an undetermined or accidental death determination is reached.

While coroners within Australia have some flexibility in using the 'balance of probabilities' as the standard of proof in reaching decisions, the decision is still one of law rather than of clinical judgement. However, this clinical judgment is often regarded as being important in cases of suspected suicide, because of the need to make an assessment of psychological processes in order to establish intent of the deceased. Making an accurate assessment of intent can be further complicated when the deceased has come from a chaotic and disorganised life, which has involved risk taking, self harming or self destructive behaviour (Farberow, MacKinnon & Nelson, 1977). Thus, in regards to understanding these often complex psychological processes and behaviours, the coroner is not necessarily an expert.

Studies conducted in England and Wales (O'Donnell & Farmer, 1995) and Ireland (McCarthy & Walsh, 1975) have found that suicide mortality rates may be higher when the determinations of suicide are based on clinical, rather than legal criteria. However, the findings of Neeleman and Wessely (1997) did not necessarily find support for these findings. They examined whether the ratio between undetermined findings and suicide determinations differed according to legal or medical qualifications of the coroner. It was found that coroners with dual medical

and legal qualifications were 1.25 times more likely than non-medical coroners to return undetermined findings, rather than suicide determinations. However, Neeleman and Wessely suggested that this surprising result might be due to doctors acting in a judicial capacity, adhering more strictly to the ` letter of the law' than those without medical degrees.

5.3 Differences in definitions and recording procedures

Although the process of reaching a manner of death determination is legally defined, coroners still have some discretion concerning the criteria for deciding how a particular death should be classified. Therefore one of the main challenges in trying to ensure consistency across decision makers and jurisdictions for suicide determinations is the application of consistent definitions. The clinical definition of suicide is open to a wide range of opinion and terminology. Recently, Silverman (2006) provided up to 27 examples of different definitions of suicide found within the literature. No definitions have been universally accepted, and there is substantial ambiguity regarding the definitions of a range of suicide related terms (Mangall & Yurkovich, 2008; Silverman, 2006). Jobes and Berman (1984, as cited in Jobes et al., 1987) found that only 37% of the 195 medical examiners they surveyed used an official or unofficial operational definition of suicide in their medical-legal certifications of equivocal suicides.

In 1998, the World Health Organisation defined suicide as "the act of killing oneself deliberately initiated and performed by the person concerned in the full knowledge or expectation of its fatal outcome" (WHO, 1998). However, to put this definition into practice can be difficult because it requires the decision maker to determine if the injuries were (i) self inflicted and (ii) involved lethal intent (O'Carroll, 1989; Rosenberg et al., 1988). As O'Donnell and Farmer (1995) noted, coroners vary in their interpretation of what evidence constitutes intent. Intentionality

can be established by verbal or non-verbal communications, or inferred from other evidence (e.g., signs of farewell, previous suicide attempt, serious mental disorder, etc., Timmermans, 2005b). However, inferring this intent in a complicated case of suicide is not always a straight forward process, and only the deceased may ever know the truth about what happened (Lindqvist & Gustafsson, 2002).

The amount and nature of information required by a particular coroner or medical examiner before he or she will certify a death as a suicide can also vary tremendously (O'Carroll, 1989). For example, it is thought that many coroners and medical examiners place a great deal of emphasis on autopsy findings, despite many deaths having an unidentifiable anatomic cause of death (Matshes & Lew, 2010), unusual or atypical circumstances (Hunsaker & Thorne, 2002; Perdekamp, Pollak & Thierauf, 2010), or the autopsy being unable to verify if the death was intentional or suspicious (Timmermans, 2005b; Timmermans, 2006; Carpenter & Tait, 2010).

Indeed, some authors have suggested that there may be an over reliance on autopsy findings regarding the cause of death of the deceased, and that this can be at the expense of uncovering the more complex circumstances of the death, particularly around gathering further evidence from the scene of death, history of the deceased, and discussions with witnesses, family and friends (Carpenter, Barnes, Naylor, Adkins, & White, 2006; Carpenter et al. 2009; Carpenter & Tait, 2010). However, as Timmermans (2005b; 2006) notes, an autopsy alone rarely provides sufficient evidence of a suicide. A study by Vanatta and Petty (1987) examined the accuracy of cause and manner of death by retrospectively examining 185 forensic cases where the medical examiner had already made an initial manner of death determination based on an external examination. It was found that when an autopsy was subsequently performed, it changed the initial manner of death determination in only one of the cases (Vanatta & Petty, 1987).

Furthermore, some certifiers will only reach a determination of suicide if a suicide note is present (Litman, Curphey, Shneidman, Farberow & Tabachnick, 1963). In an early study by Farberow et al. (1977), coroners reported that when certifying deaths, 28 percent stated that they require more proof for suicide than for other manners of death, and 17 percent reported that the information that they require is a suicide note or history of attempted suicide. However, in the majority of suicides, amongst adults, children, adolescents, and the elderly, a suicide note is not always left behind (Koehler, 2007; Garfinkle, Froese & Hood, 1982; Wong, Yeung & Chan, 2008; Ho, Yip, Chiu & Halliday, 1998). The rates of suicide notes being left behind after an apparent suicide vary, with figures ranging from 4% (O'Donnell, Farmer, & Catalan, 1993) to 43% (Salib, Cawley, & Healy, 2002).

It is also well documented that coroners tend to have a very high threshold for determining suicide deaths for children and young people (Madge & Harvey, 1999). Some medico-legal professions employ a cut-off age of whom they will consider capable of committing suicide (Jobes et al., 1986). Different classification thresholds can also exist for more equivocal causes of death. A study by Breiding and Wiersema (2006) examined variations in classifications of undetermined poisoning deaths across three states in the USA. It was found that states that had a higher number of undetermined deaths, also tended to have fewer unintentional deaths. The authors suggested that this variation might be due to each State using different classification criteria for poisoning deaths (Breiding & Wiersema, 2006).

The way decisions are recorded can also vary. For example, a coroner who has concluded that a death was due to a suicidal jump from a height might describe this intent in a forthcoming manner (e.g., 'jumped from building with the intention of taking his life') or a less forthcoming manner (e.g., 'multiple injuries due to fall from a great height'), depending on regulatory requirements, or personal judgment and

preference (Freckelton & Ranson, 2006). Bennewith et al. (2005) conducted a study involving coroners across 24 jurisdictions in England. They investigated whether there was consistency in the type of information that was recorded by the coroner, including toxicology reports and information about firearm storage. In general, they found wide variation across the different coroners in what evidence was gathered relevant to specific methods.

However, some studies have found that the different certification procedures do not necessarily influence manner of death determination outcomes. For example, Ross and Kreitman (1975) compared English and Welsh coroners and Scottish coroners, who use markedly different procedures for certifying deaths. It was found that there were no differences in the decisions made on a consecutive series of cases between the officials from the different regions. Thus, any differences in suicide mortality rates observed between England and Wales and Scotland were not considered to be the result of different certification procedures.

5.4 Training and experience levels of coroners

Even with extensive and reliable information and expertise input from other professionals, the modern coroner demands highly honed skills in administratively managing what can be very complex investigations, in presiding over public inquests, writing sophisticated analyses of evidence, making recommendations, and evaluating sometimes conflicting information from expert sources (Freckelton, 2007). Training for coroners to support them in this role remains limited. In some jurisdictions there are some training programs and conferences dedicated to coroners' practice, but this is a reasonably new phenomenon (Freckelton, 2007). A number of studies have examined level of experience, and how this can influence the quality of coroners' determinations. Parai et al. (2006) found that increasing years of work as a coroner had mixed results in terms of correct classification on fictional

scenarios. In the group that examined suicidal intention, more than five years experience as a coroner was associated with decreased odds for a correct manner of death in cases of suicide. Conversely, more than five years of experience as a coroner was associated with increased odds of a correct manner of death determination for accidental deaths.

A study by Smithey and Ramirez (2004) investigated level of suspicion of death certifiers when ruling on infant deaths. It was found that while personal and social factors of the certifier have little or no effect on their level of suspicion, they did find that there is potential for inaccurate rulings due to lack of training, education and resources available (dependant on the circumstances of the death, and if the certifier was a coroner or medical examiner). Specifically, for a scenario where an infant fell down a set of stairs, each additional hour of certifier training increased the odds that they would not view the death as an accident by 71%, almost doubling the odds of suspicion per hour of training (Smithey & Ramirez, 2004).

Jarvis et al. (1991) examined the relationship between age, years of experience, and number of cases per year, and the proportion of manner of death determinations. They found that younger examiners tended to make more undetermined decisions, and fewer accidental determinations. Older examiners (40 to 54 years) were less likely to produce undetermined certifications. Suicidal determinations did not vary by the age of the examiner. It was also found that examiners with a moderate level of time on the job (five to nine years) made fewer undetermined decisions, and more determinations of suicide than either their less or more experienced colleagues. The variation in manner of death determinations by the number of cases seen per year was strongly significant. Examiners who saw the most cases per year made the most undetermined classifications (37.3%), while those who saw the fewest cases selected only 24.3% as undetermined. The reverse was seen for

accidental deaths, with those seeing the fewest cases making 24.3% of the accidental death determinations, while those with the most cases classifying half as many accidental deaths (12.9%) (Jarvis et al., 1991). In summary, it seemed that older examiners who have spent longer in practice are more willing to make distinctions in regard to manner of death, compared with the younger examiners who tend to work in larger places with more cases.

5.5 Consistency with other professionals

Coroners depend substantially upon the expertise of others for the pre-inquest investigations, and during the course of an inquest. Therefore, medical practitioners and police officers can act both as gatekeepers to notifications of reviewable and reportable deaths, and as assistants in the investigative process (Freckelton, 2007). However, there is limited research that has investigated the degree of agreement between the coroner, pathologists and police officers. An early study by Barraclough, Holding and Fayers (1976) reviewed 330 cases of unnatural deaths from the Inner West London Coroner's district to examine if particular coroners or pathologists were associated with a disproportionate number of suicide determinations. No significant deviations from the expected numbers were found, suggesting that coroners and pathologists probably shared common ideas about the features that defined suicide (Barraclough et al., 1976).

Theoretically, there should be relative consistency between investigating police officers, and the coroner given that several jurisdictions across Australia (including Australia Capital Territory, Queensland, Tasmania and New South Wales) have introduced a standard national police form that records evidence of suspected suicide and demographic data (De Leo et al., 2010), although this is not necessarily the practice in all jurisdictions globally. A study by De Jong and Hanzlick (2000) evaluated the level of agreement between medical examiner investigator's opinion

(who largely come from a law enforcement background) and the final manner of death determination by forensic pathologist examiners in Fulton County, Georgia. They examined 15, 771 deaths reported to the Office of the Fulton County Medical Examiner between 1988 and 1997. While a high degree of correlation (88%) was noted between the opinions of the medical examiner investigators and the forensic pathologist examiners in determining manners of death, there were discrepancies in 1908 cases. The greatest number of discrepancies resulted when the investigator's opinion regarding the manner of death was undetermined and the manner of death was classified differently by the forensic pathologist examiners, namely natural (n= 745), accident (n=718), homicide (n =718) or suicide (n = 49) (De Jong & Hanzlick, 2000).

A similar finding was made by Barraclough and Harris (2002), who examined 327 murder-suicide deaths (based on police classifications) in England and Wales between 1988 and 1992. The authors found that there were a number of cases whereby the coroner's final verdict differed from the police classification, with the coroner reaching undetermined or accidental death determinations for 20 of the incidents classified as homicide or suicide by the police. The authors suggested that these differences might be due to the public nature of the coroner's decision (usually with relatives present), and the coroner reaching a "less stigmatising, more sympathetic, and possibly less accurate conclusion" (Barraclough & Harris, 2002, p. 583).

In a more recent study, Burrows and Laflamme (2007) investigated the decision making processes underlying determinations of suicide in South Africa through semi-structured interviews with 32 medical practitioners (who are required to record the "apparent manner of death" on the National Injury Mortality Surveillance System, which is the only source of suicide mortality data currently

available in South Africa). They found that the majority of medical practitioners (63%) stated that they used police information; with its specified manner of death (e.g., a "gunshot suicide") as the basis for planning a post mortem examination. However, in regards to the perceived reliability attributed to the police history, this varied, with some arguing that in 95-99% of cases the police history fitted with the injuries, while at the other extreme, police information was considered too sparse and inaccurate to provide useful information (Burrows & Laflamme, 2007). Given the variation regarding the professional backgrounds of investigators and certifiers of manner of death across the world (and the general the lack of literature in this area) the relationship between the coroner and other professionals warrants further investigation.

Chapter 6. Sources of Variability: Social Pressures, Beliefs and Biases

6.1 Child suicide

There has been an extensive amount of literature surrounding the concept of suicide in childhood. Much of this research suggests that coroners and medical examiners vastly underreport the true prevalence of suicide in childhood, and that this may be due to a number of different factors. This includes stigma attached to suicide (Rudestam & Imbrol, 1983); misconceptions about children's understanding of death (Greene, 1994; Mishara 1999; Crepeau-Hobson, 2010); and lack of training around childhood suicide (Nelson & Crawford, 1990). However, contrary to these wide held beliefs, research has found that children as young as five to nine years of age are developmentally capable of understanding the concept of suicide (Mishara, 1999) and can demostrate clear and intended suicidal behavior (Cohen-Sandler, Berman, & King, 1982; Pfeffer, 1994).

The results of several studies suggest that official statistics on children's suicides significantly underestimate the actual frequency of suicide rates, particularly for the younger age groups (Cohen-Sandler et al., 1982; Hoberman & Garfinkel, 1988; Matter & Matter, 1984; Pfeffer, Lipkins, Plutchik, & Mizuchi, 1988). Researchers suggest that childhood suicides are often mistaken for accidents (Paulson, Stone & Sposto, 1978; Madge & Harvey, 1999) or simply classified as undetermined (Sorenson, Shen & Kraus, 1997a). A study by Gosney and Hawton (2007) examined unnatural deaths of young people aged between eight and 18 years of age, and asked a panel of child psychiatrists to review them to determine whether they were suicides based on the balance of probabilities. It was found that based on the determination of probable suicides, the total number of suicides was underestimated by 65%. These results are consistent with a study by Madge and Harvey (1999), which investigated deaths in 0 to 19 year olds in North London

between 1980 and 1996. It was found that approximately a third of probable suicides (the youngest of which was nine years old) received a final verdict of misadventure (i.e. accidental death).

Many medico-legal professionals actually employ an arbitrary cut-off age (such as ten years old) for determining whether a child is psychologically capable of committing suicide (Jobes et al., 1986; Crepeau-Hobson, 2010). Crepeau-Hobson (2010) conducted a survey of 94 medical examiners, and found that two-thirds of the respondents refer to an age limit when reaching determinations of suicide, and would never classify a child's death as suicide regardless of the circumstances. This age cut-off varied considerably, ranging from two years to 12 years, with an average of approximately eight years. Eighty-eight percent of the respondents who advocated for a cut-off age indicated that they would not classify a child's death as a suicide if the child was under the age of 10.

Mishara (1999) states that during his discussions with various coroners and medical examiners, they were often reluctant to classify self inflicted deaths in children as suicide because of a general belief that children do not fully understand the implications of their actions. Thus, there is a belief that children may be incapable of committing suicide, even when there is evidence that their death was the result of a self inflicted injury or lethal behaviour. In a review of deaths by hanging in Western Australia conducted by Cooke, Cadden and Margolius (1995), it was found that childhood hangings were nearly always determined accidental "based on presumed lack of fatal intent as a result of immaturity and a humanitarian wish to comfort the family" (p. 272).

Despite these beliefs, research by Cohen-Sandler et al. (1982), Mishara (1999) and others have found that children as young as five are able to understand the concept of suicide, and can also demonstrate clear and intended suicidal

behaviour. Normand and Mishara (1992) interviewed children aged five to 11 about their understanding of death and suicide. They found that detailed knowledge of suicide appears to be closely related to a child's development of the concept of death. These findings where further explored by Mishara (1999), who interviewed school children in grades one to five about the experience and knowledge of death and suicide. It was found that while younger children (aged six) may not necessarily know the meaning of the word "suicide", they generally have an understanding of "killing oneself", and are aware of the unsettling effects of such talk on adults. This understanding increased with school year, with third grade children (aged eight to nine) demonstrating an elaborate understanding of suicide, and even being able to name at least one means of committing suicide. Further, by grade five (aged 10 to 11) almost all of the students surveyed understood the psychosocial dynamics that can lead to suicide (Mishara, 1999). In general, the research suggests that by the age of 10, most children understand what suicide means.

In addition to this understanding, the results of research show that children as young as six have thought about and attempted suicide in the past. For example, in Mishara's study (1999), fourteen percent of the sample indicated that they had in the past considered suicide (although none had actually attempted). Similarly, Pfeffer et al. (1988) asked a sample of 101 normal school aged children between the ages of six and 12 if they ever thought about killing themselves. It was found that 8.9% of the sample indicated that they had thought of killing themselves, while another two percent had either threatened to commit suicide or reported that they had attempted suicide. This is also supported by Bolger, Downey, Walker and Steininger (1989) who found that 25% of preadolescents and 40% of adolescents surveyed have considered suicide at least once. Furthermore, researchers appear to discount the belief that children are unable to carry out suicide due to their lack of size, strength,

motor coordination, and ability to obtain needed materials. Documented suicides by children and adolescents have resulted from a range of methods including jumping from heights, intentional drowning, stabbing, running in front of moving vehicles, scalding, hanging and firearms (Schmidt, Muller, Dettmeyer & Madea, 2002; Goren, Gurkan, Tirasci & Ozen, 2003; Shaw, Fernandes, & Rao 2005; Singh & Lathrop, 2008).

Another factor that may influence the rates of reported childhood suicide is the perceived stigma surrounding childhood suicide, and the negative impact this can have on the deceased's family and friends. Researchers have explored the negative perceptions surrounding childhood suicide, in particular on the parents of the deceased child. Rudestam and Imbrol (1983) studied community attitudes towards fictitious suicide and non-suicide deaths of children. They found that for the suicidal cases, respondents were more likely to label the child as mentally ill, and to blame and stigmatise the parents of the deceased child, resulting in increased stress and less social support for the bereaved family. Similar results were found by Calhoun, Selby and Falustich (1980), who investigated the responses of adult participants to specially prepared newspaper accounts of a child's death. The results indicated that when the child's death was described as a suicide, parents were viewed in a more negative way than when the child's death was described as being the result of illness. This result was supported by another study by Calhoun, Selby and Faulstich (1982), who also found that the presence of environmental pressures (e.g., school failure), which reduced potentially negative perceptions of parents when the child's death was due to a disease, did not have a similar impact when the child's death was due to a suicide.

In addition to these beliefs and attitudes regarding childhood deaths, determinations of suicide could also be influenced by a lack of forensic evidence. In

general, asphyxial deaths due to hanging are considered rare occurrences in younger children (Luke, 1967; Clark, 1993), but this is still the dominant method of suicide in younger children (Singh & Lathrop, 2008; Crepeau-Hobson, 2010). Clark et al. (1993) reviewed 12 cases from an Indiana Coroner's office involving the hanging deaths in children aged 13 years of age or younger. From these twelve cases, hanging deaths in the age range of six years or less were all classified as accidental. Equivocal cases and the clear-cut suicide cases all involved males, and were all aged six years old and above. A recurrent problem noted in these cases was the lack of information available about the ligature, knot and details of the suspension. This is in large part the result of distraught parents, relatives or friends attempting to resuscitate the child (Clark, et al., 1993). Thus, some crucial information required to make determinations in these cases may be missing, and impact upon reaching an accurate classification of the death.

Decision makers may be faced with additional difficulties in establishing intent in cases of child deaths. In Crepeau-Hobson's (2010) survey of what medical examiners consider when reaching determinations of childhood suicide, a third of respondents said that unless there was strong evidence of suicidal intent, they would err on the side of an accidental determination. However, in most studies of child suicide, it has been found that only a small minority of children actually directly communicate suicide intent (Schmidt et al., 2002). Other factors, such as the phenomenon of choking games in children and youth, can further complicate an establishment of intent (Knoll, 2009; Andrew & Fallon, 2007). Furthermore, behavioural components, such as impulsivity and their interaction with environmental-contextual factors play an important role in suicidal behaviour of pre-pubertal children (Pfeffer, 1994). However, some of these factors are not taken into consideration by the decision-maker. Crepeau-Hobson (2010) found that one third of

respondents did not differentiate between child and adult suicide determinations, suggesting a lack of education and training in child mental health and development.

In addition to the results of previous research indicating the under-classification of suicide in children, there is some evidence to suggest that the reverse may also occur, whereby accidents are wrongly classified as suicides. Groholt and Ekeberg (2003) examined information from registered suicides of young people under the age of 20 years in Norway. These cases were reviewed and re-classified as certain, uncertain or improbable suicides. People under the age of 15 years were compared to older adolescents over the age of 15, and it was found that uncertain or improbable suicides were significantly more common in the younger age group. It was also found that the very young with uncertain suicides had very few risk factors such as mental disorders, broken families, known stressors or precipitants, suicide intent or farewell notes. Groholt and Ekeberg state that in some of the cases examined, there is evidence to suggest that the child was experimenting or imitating models from television or fiction, and these should be classified as an accident rather than suicide.

Other researchers have also investigated the under-classifications of homicide determinations in cases of sudden or unexpected child deaths. Sorenson et al. (1997a) found that injury deaths of children under the age of five years of age follow a different pattern of classification than older age groups. It was found that even when sex, race, ethnicity, country of birth, place of injury, and external cause of death are taken into account, 2.9% of injury deaths for newborns to four year olds were classified as undetermined in comparison to 1.9% for all ages. Based on this finding Sorenson, Shen and Kraus (1997b) investigated whether undetermined injury deaths of infants and toddlers are more similar to accidents or homicides. Deaths of 12, 246 children under the age of five were examined using Californian mortality data from

1969 to 1991. Characteristics of the dead child, injury event and post-mortem evidence were compared for accidents, homicides and undermined deaths. A logistic model was then used to predict whether undetermined deaths were more likely to be accidents or homicides. The predictive model indicated that 43.8% of the undermined injury deaths were similar to homicides on several characteristics. The study concluded that the true rates of homicide deaths for infants and toddlers may be nearly one fifth and one tenth (respectively), if the undetermined deaths that resemble homicides are taken into account (Sorenson et al., 1997b).

6.2 Culture and race

In addition to beliefs about the age of the deceased, social and cultural factors may also impact upon manner of death determinations. Under some legislation within Australia, the coroner is required to have regard to cultural considerations when reaching a decision. For example, the Victorian Coroners Act (2008) stipulates that the decision maker should have consideration "that different cultures have different beliefs and practices surrounding death that should, where appropriate, be respected". Thus, the coroner may be faced with a number of challenges if the deceased comes from a culture whereby suicide is prohibited or viewed unfavourably.

Under Chinese culture, there are beliefs about the evil effects of the 'wandering spirits' of persons who have died from suicide (Pearson, 1995). As a result, families bereaved by suicide may consequently experience a great deal of shame about the death, and demonstrate a reluctance to admit that it was a suicide. Families may try to cover up the suicide, or explain the death via alternative explanations. However, Phillips, Liu and Zhang (1999) argue that the relatively high suicide rates seen in China may actually suggest lower rates of deliberate misclassification, compared with other countries where suicide results in serious social, financial and legal repercussions for the family. In some African countries

such as Nigeria, a case of suicide often makes it impossible for a family to find husbands for its female members (Ritter et al., 2008). Similarly, in Pakistan, attempted suicide is punishable and usually entails fines or prison sentences (Ritter et al., 2008).

The racial characteristics of the deceased have also been associated with discrepancies in manner of death determination. An early study by Warshauer and Monk (1978) investigated the accuracy of suicide statistics by examining deaths classified by a New York Medical Examiner between 1968 and 1970. Cases in which the final determination was suicide, were compared with other deaths initially considered to be suicide by the medical examiner, but never officially classified as such (referred to as "assigned suicides"). It was determined that African American suicides were underestimated by 80 percent, while Caucasian suicides were underestimated by 42 percent. One of the reasons used by Warshauer and Monk to explain this large discrepancy is the difference in the types of methods used. Three quarters of the African American suicides examined used methods that were less likely to be classified as a definite suicide, including jumping and "other" methods (e.g., stabbing, pedestrian deaths and drowning). On the other hand, the Caucasian suicides largely involved methods that were more likely to be classified as suicides, such as guns, hanging or ingestion. More recently, Rockett, Samora and Coben (2006) examined suicide rates in the United States to determine whether there are different rates of suicide classification according to race. Results indicated that there was a greater susceptibility of medico-legal authorities to misclassify African American suicides than Caucasian suicides.

Within an Australian context, there has been little research done on the association between race or cultural background of the deceased and manner of death determination. Researchers suggest that Indigenous Australians aged 12–24 years

have suicide rates four times greater than non-Indigenous Australians (Eldridge, 2008). However, as Tatz (1999) notes, Aboriginal suicides are frequently under-reported and under-recorded, and may be as much as three or four times higher (especially for young males) than the rates stated in official documents and research papers. In general, there has been a lack of adequate studies investigating Aboriginal suicide rates due to challenges collecting accurate information about incidence of Aboriginal suicide in remote communities, unsystematic recording procedures and the process of clearly defining Aboriginality (Cantor & Neulinger, 2000).

Despite a lack of literature regarding some indigenous populations, there is no doubt that there is great variability in national and international mortality rates. Notably, there is a lack of suicide data for more that half of the world's countries, especially in developing nations in Asia, Africa and South America (Khan, 2005; De Leo, Milner & Xiangdong, 2009). Indeed, WHO reports that while 85% of suicides in the world occur in low to middle income countries, there is no available data for 73% of these countries. Khan (2005) suggests that suicides do occur in these non-reporting countries, but due to a number of religious, legal and cultural factors, data collection and reporting is often neglected.

In developed countries, there is also variability, however, it is not clear whether these differences reflect reality, or are a reflection of differential certification practices in different countries. A study by Atkinson, Kessel and Dalgaard (1975) investigated these differences by comparing the decisions made by English and Danish coroners on a blind basis, by getting each to examine a sample of each other's case records. It was found that the Danish coroners returned a suicide verdict in a higher proportion of cases than English coroners for the same case material. The authors indicated that this result might have been due to the more open attitude, and less stigmatising view towards suicide within Denmark, compared to the

United Kingdom. However, it was also suggested that it might be national differences in the certification process utilised in each country, with Denmark utilising a lower level of probability to return a suicide verdict (Atkinson et al., 1975)

This issue was also explored in an earlier epidemiological study by Sainsbury and Barraclough (1968). They obtained suicide rates among migrants to the United States in 1959 and then ranked them against the suicide rates for migrants' countries of origin. The rank order of the two sets of rates produced a product moment correlation ($r=.87$, $p<.0001$), which was considered highly consistent. While certification processes differed between migrants' countries of origin, the certification process in the United States was generally the same. This suggests that any differences between countries were not the result of differences in certification processes, and that immigrant groups were to some extent predisposed to suicide as a result of their experiences in their original countries. This result has since been replicated by other studies using data from England, Wales, and Canada (Kliewer, 1991) and Australia (Kliewer, 1991; Burvill, Woodings, Stenhouse, & McCall, 1982; Burvill, 1995).

While different certification procedures do not appear to prevent comparisons of national and international mortality rates, cultural differences may still foster manner of death misclassifications. As Warshauer and Monk (1978) suggested, some social and cultural variation in suicide patterns may be accounted for by the different suicide behaviours and preferred suicide methods. It is thought that social acceptability of method (i.e., culture and tradition) and its availability (i.e., opportunity) can contribute to the choice of suicide methods and societal patterns of suicide (Farmer & Rohde, 1980; Stack & Wasserman, 2005). A study by the World Health Organisation (Ajdacic-Gross et al, 2008) found wide variability in the methods used between countries, with hanging the predominant method in eastern

European countries (i.e., Estonia, Latvia, Lithuania, Poland and Romania), firearms the most common method in the United States (but also prevalent in Argentina, Switzerland and Uruguay), jumping from a height featuring in Hong Kong, Luxembourg and Malta, poisoning with pesticides featuring in Asian countries (e.g., the Republic of Korea and Thailand) and Portugal, and poisoning with drugs featuring in Canada, the Nordic countries and the United Kingdom. Given that less violent and lower lethality methods, such as poisoning feature more predominantly in some countries, this may pose additional challenges for certifiers in these regions, due to these types of death being more difficult when it comes to establishing intent (Cantor et al., 2001; Stanistreet et al., 2004; Donaldson et al., 2006).

6.3 Religion

While there has been little to no research investigating the relationship between religion and manner of death outcome, there have been a number of studies that have examined the relationship between religion and an individual's beliefs about suicide. In general, suicide and religious beliefs are closely interwoven, with most major religions having implicit or explicit prohibitions against suicide (Domino & Leenaars, 1995). Neeleman, Halpen, Leon and Lewis (1997) found that stronger religious beliefs are associated with lower tolerance of suicide. Similarly, Domino and Leenaars (1995) investigated attitudes towards suicide through the administration of the Suicide Opinion Questionnaire using a sample of 196 Canadian adults. In their sample, 71% agreed, and 14% disagreed with the statement that "suicide goes against the laws of God and/or of nature", 52% agreed that "people who attempt suicide are, as a group, less religious" (Domino & Leenaars, 1995). Thus, if a coroner adheres to such religious beliefs, it is possible that this will generate a reluctance to reach a determination of suicide. One of the few studies that has investigated the impact of a medical examiner's religious background on manner

of death determinations, is the experimental study undertaken by Jarvis et al. (1991). Case vignettes were presented to a sample of Canadian medical examiners. It was found that characteristics of the examiners, such as their religious background, were related to significant differences in certification judgements. Specifically, it was found that Roman Catholic and non-Christian examiners classified the fewest deaths as suicides, and those not in any organised religion judged the most deaths to be suicide (Jarvis et al., 1991).

Similarly, if the deceased's family hold strong religious convictions, they may place pressure upon the coroner not to certify the death as a suicide. As Brooke and Atkinson (1974) notes, there may be some hesitancy from some families to ascribe to the death of a loved one as suicide, if there are religious restrictions on place of burial and types of service held if the death is known to be a suicide. However, further research is needed in this area to fully understand if such beliefs are influential in coronial decision making.

6.4 Social stigma

Another factor which may influence a determination of the manner of death, is the potential stigma attached to a label of suicide. The presence of a suicide stigma can be associated with a number of different factors, including the victim's age (especially children, as previously noted), social standing, distress inflicted on the deceased's family or community, cultural or religious interests, and financial interests (i.e., insurance claims) (De Leo et al., 2010). Within Australia, the presence of this stigma can even be observed in current legislation, with the Queensland 'Births, Deaths and Marriages Registration Act' (2003) prohibiting the use of 'suicide' being entered into the official death register (De Leo et al., 2010).

There has been considerable research into the relationship between suicide and stigma, especially around individuals who have made previous attempts to take

their own life. For example, Lester (2006) investigated undergraduate student views of people who have attempted suicide, using an eight-item questionnaire. Lester found that 20% would not allow an immigrant who has attempted suicide to become a US citizen, and 52% would not date someone who had attempted suicide. Previous studies by Lester (1992, 1993) have also found that more prejudice is placed against individuals based on psychiatric/medical categories than on ethnic and religious categories.

Considerable stigma can also be attached to the friends and family of individuals who have successfully committed suicide. This may be because the act of suicide may by viewed by others as failure on the part of the victim's friends and family to help deal with some emotional issue of the deceased, and therefore affix blame on them for the loss. Reviews by Calhoun and Allen (1991) and Jordan (2001), and individual studies by Allen, Calhoun, Cann and Tedeschi (1993) investigating the social responses to suicide, have consistently found that suicide survivors (i.e., the loved ones of the deceased) are perceived in a different and more negative fashion than mourners with a different type of loss. For example, Allen et al. (1993) found that individuals bereaved by suicide tended to be viewed as more psychologically disturbed, less likeable, more blameworthy, more ashamed, more in need of professional mental health care, and more likely to remain sad and depressed for longer.

Examining this phenomenon in a specific cultural context, Domino and Leenaars (1995) investigated attitudes toward suicide among English speaking urban Canadians. They administered the Suicide Opinion Questionnaire with a sample of 196 Canadian adults. In response to the item "I would feel ashamed if a member of my family committed suicide", 41% agreed, 33% disagreed, and 26% were undecided. Post-administration interviews suggested that those undecided were

undecided because they felt some shame, which would suggest that two out of three Canadians sampled hold some degree of stigmatising beliefs about suicide. Forty-six percent of the sample agreed that "in general, suicide is an evil act not to be condoned" and 63% agreed that "suicide is a very serious moral transgression".

These views can also create considerable stress on the survivors. Even if others demonstrate compassion for the mourner, they may fear that others are judging them, and therefore withdraw or inhibit social supports form others (Jordan, 2001). Dunn and Morish-Vidners (1987) refer to this process as "self stigmatisation" (p. 177) For example, Van Dongen (1993) found that suicide survivors worried more about what other people thought of them, felt uncertain about how to act and what to share with others, and believed people around them were not sure how to act in their presence. In a study by Range and Calhoun (1990), it was found that suicide bereavement participants felt more pressure to explain the death, lied about the death, and reported that they felt that others treated them differently, compared to natural death survivors. In addition, it was found that only 27% of suicide survivors reported positive changes to their social interactions, compared to 76% of those bereaved by accidental death.

There is a general presumption that relatives either conceal evidence or pressure death investigators to class deaths differently to avoid social, religious, legal or financial stigma (Massello III, 1986). Timmermans (2005a; 2006) argues that manner of death determinations often involve a process of "death brokering" whereby the medical authority (or coroner) attempts to negotiate a culturally acceptable death. Timmermans states that different audiences have different stakes in the outcome of death investigation. For example, friends and relatives are often motivated by the potential stigma implied by a particular death category, and therefore may contest their loved one's death classification if it is determined to be a

suicide. On the other hand, public health officials and law enforcement officers are concerned about the reliability of findings, and therefore want accurate mortality statistics. The coroner or medical examiner must therefore come to a decision that meets the moral standards of the different players in each case. These considerations can be observed in the Victorian Coroners Act (2008), which states that as far as possible in the given circumstances, the coroner should have regard for "the need to balance the public interest in protecting a living or deceased person's personal or health information with the public interest in the legitimate use of that information".

Chapter 7. Sources of Variability: Decision-Making Theories

As discussed, there are a number of complex legal, systemic, social and cultural factors that may be working together to influence the manner in which coroners reach decisions. In addition to this, there may also be psychological processes at work, with a number of decision-making theories that could account for variability in coroners' decision making.

7.1 Heuristics

As Smithey and Ramirez (2004) point out, if manner of death certifiers believe that injuries are highly representative of accidents, then they are likely to believe that the injury is caused by an accident. This phenomenon is known as the 'representativeness heuristic', and refers to the process of basing an estimated probability of an event on how similar it is to the typical prototype of that event (Kahneman & Tversky, 1973; Tversky & Kahneman, 1974; Kahneman, Slovic & Tversky, 1982). Thus, if the circumstances of a death do not appear highly representative of a suicide, the certifier is likely to make an alternative determination. On the other hand, the 'availability heuristic' refers to the tendency of individuals to make a judgement of the frequency or likelihood of events occurring, based on the ease with which they can bring these events to mind. For example, a coroner may be reluctant to determine a child's death as a suicide due to the predominant view that it is an infrequently occurring phenomenon. Heuristics can be useful mental shortcuts used in clinical decision-making. However, they can occasionally fail and lead an individual to make systematic biases, especially when relied upon exclusively, and other information (such as prior probabilities) is disregarded. This can become problematic if an initial decision is made about an individual's manner of death without considering additional information, and thus prematurely closing an inquiry (Smithey & Ramirez, 2004).

7.2 Story Model

A number of theories have been proposed to explain the process in which individuals reach decisions in complex and uncertain situations. In day-to-day life, people spontaneously construct causal theories to make sense of the huge amount of information they receive from their social environment (Nisbett & Ross, 1980). Such causal attributions of behavioural evidence can often be made without conscious awareness (Gilbert, Krull, & Pelham, 1988; Winter & Uleman, 1984). Pennington and Hastie (1986; 1988; 1992) proposed a model for causal explanation-based decision making in legal contexts (also referred to as the 'Story model'). According to this model, decision makers begin their decision making process by constructing a causal model (i.e., a narrative) to explain the available facts. A decision is made when the causal model of evidence (the individual's accepted story), successfully matches one of the different verdict alternatives. Causal theories have been used to explain how jurors put together evidence in a coherent manner to facilitate their decision-making. It has been found that rather than processing complex bodies of evidence in a fractional manner as it is presented in court; jurors tend to incorporate evidence into coherent memory structures corresponding to causal stories. In theory, this decision making process could also be applied to coroners, who must piece together information and evidence to develop a narrative to explain the circumstances that led to a particular death.

7.3 Confirmation bias

If a decision maker strongly commits to a single causal explanation of evidence, this could be potentially detrimental to the course of an investigation. Indeed, it has been suggested that the process of assessing and reasoning through a particular situation is highly sensitive to prior information, and can be strongly influenced by previously held beliefs, perspectives and hypotheses. This process is referred to as

'confirmation bias'. Studies investigating confirmation bias show that people tend to seek evidence and select information that helps confirm existing beliefs and ignore or discount contradictory evidence (Klayman & Ha 1987; Nickerson, 1998, Cook & Smallman 2008). Research has demonstrated that different professions such as jurors, lawyers, physicians, police officers and psychologists develop preliminary hypotheses very quickly, and are reluctant to revise them regardless of the presence of additional information (Colwell, 2005; Kassin & Gudjonsson, 2004; Lopez, 1989; Meehl, 1960). Such a biased interpretation can pose significant problems in criminal investigations if investigators use a piece of information to support a working hypothesis, without considering if the same evidence could also reasonably explain an alternative hypothesis. Furthermore, an investigator may fail to abandon a false hypothesis, regardless of the discovery of other objective evidence that may reasonably disconfirm or discount it (Ask & Granhag, 2005).

In a legal context, Carlson and Russo (2001) found that despite repeated instructions to avoid pre-emptive judgments, mock jurors in both civil and criminal mock trials selectively interpreted new evidence in line with whichever verdict was being favoured at that stage of the trial. Carlson and Russo referred to this type of confirmation bias as a 'pre-decisional distortion'. Similarly, Ask and Granhag (2005) investigated the role of confirmation bias in criminal investigations, and whether investigators misinterpret evidence to support their initial hypothesis. Participants were provided with one of two scenarios in which a murder suspect was either presented as having a clear motive (high guilt condition), or there was a serious possibility of an alternative perpetrator (low guilt condition). It was found that when exonerating information (e.g., a witness saw a third person running from the crime scene) was presented, both groups did not differ in their ratings, suggesting that participants were influenced by their initial hypothesis in regards to how they

processed subsequent crime-related information. In regards to coroners, the presence of the confirmation biases may lead coroners to reach decisions based on the face value of a case, at the expense of a more detailed evaluation of the case evidence. While there is little to no research directly examining the relationship between coroners decision making and the confirmation bias, Perper, Juste, Schueler, Motte and Cina (2006) recommended that death certifiers need be wary of the confirmation bias process, and that it "should be avoided, particularly when evaluating ambiguous evidence" (p. 1633).

7.4 Prototype model

More recently, Lester and Fleck (2010) investigated the decision-making processes involved in suicide certification, and proposed a model of coding semantic information, called the 'prototype model'. Similar to heuristics, prototypes involve abstracting the central features of a category, then formulating an idealised item that is seen as most typical of that category. When the decision maker is determining how to best categorise a particular scenario, they assess the extent to which an example fits the prototype. As a result, the end conclusion is not all or nothing (e.g., yes *vs* no) but is rather ascribed a level of membership ranging from low to high. In regard to determining suicide, Lester and Fleck argue that decision makers do not determine if a particular action is suicide or not, but rather the extent of resemblance to the prototypical suicide. Lester and Fleck explored this theory by presenting 51 students and 20 suicide experts with 20 different scenarios, and asked them to judge if they thought the behaviour represented a suicide or not. It was found that a large percentage of students and experts judged particular deaths as suicide, despite the absence of suicide intent. Lester and Fleck suggested that this result was because both the lay and expert participants applied a prototypical approach to determining suicide, rather than assessing it against a specific criterion. If this type of decision-

making were true to coroners, it would have considerable consequences for the consistency and accuracy of suicide determinations.

Chapter 8. Variables that Predict Manner of Death Determinations

Because there seems to be inconsistencies in determining manner of death in regard to equivocal deaths, it would be useful to be aware of the specific factors that coroners consider when reaching a verdict. This may help in the future development of a standardized set of criteria that coroners could use to investigate, evaluate and to determine manner of death more uniformly.

8.1 Statistical models

There have been a number of studies that have surveyed coroners' records, and used statistical analyses (e.g., logistic regression) to determine which variables are the greatest statistical predictors of manner of death outcome. In one of the earliest studies, Walsh et al. (1975) used linear probability function analysis to determine which factors were the most influential in a sample of Dublin coroners. In total 201 deaths were examined, including 58 cases determined to be suicide, and 143 cases determined to be non-suicide. It was found that cutting, hanging, drug and gas related deaths were significantly more likely to receive a suicide determination, than those who died from drowning, jumping, shooting or poisoning. Finally, if the deceased left any intimation of a suicidal intent, or if the deceased was under the age of 40 years old, this also increased the likelihood that a suicide determination would be returned.

A number of other studies have conducted similar investigations using logistic regression analysis. Stanistreet et al. (2001) examined the factors used by coroners to distinguish between suicide and accidental deaths among young men in Merseyside and Cheshire in the United Kingdom. The final sample included 130 deaths that received an accidental death/misadventure determination, and 60 deaths that received a suicide determination. Data sources included coroners' inquests, general practitioner notes and hospital records, and information was collected on

predetermined behavioural and substance abuse factors. A logistic regression analysis found that an active mode of death (including hanging, shooting, falling and stabbing) was the strongest predictor of suicide determination. Evidence of intent was also found to strongly predict suicide determinations. An uncharacteristic change in behaviour prior to death was also a significant factor when considered alone but became less important when adjusting for other factors. There was also a significant but weak relationship between history of psychiatric contact and suicide determinations. Similarly, history of deliberate self harm was a significant predictor of suicide determinations, but not as strong as method of intent (Stanistreet, et al., 2001).

A series of similar studies was conducted by Salib (1996) and Salib (1997), investigating suicide and undetermined manner of death determinations made by North Cheshire coroners. The methodology used by both studies was similar, but with the latter study examining deaths of the elderly persons aged 65 years and above. Both studies found similar results, with logistic regression analysis suggesting that having evidence of 'intent' (e.g., leaving a note, telling someone, or having a serious recent suicide attempt), an active cause of death (from hanging or car exhaust) were more likely to attract a suicide determination. On the other hand, deaths from overdose, drowning or falling were more likely to be returned as an undetermined manner of death determination. It was also found that having a formal psychiatric history (i.e., a history obtained directly from a psychiatrist or hospital notes) increased the probability of the coroner returning an undetermined finding, whereas having an 'informal' psychiatric condition (defined from other sources, such as family, friends, neighbours or GPs) was more likely to result in a suicide determination (Salib, 1996; 1997). In comparing the results, Salib (1997) found that

in regards to the younger age group, history of alcohol abuse was also associated with undetermined findings.

More recently, Lindqvist and Gustafsson (2002) examined 100 cases determined to be suicide, and 22 case of an undetermined manner of death in Vasterbottens County (Sweden). Using chi square and logistic regression analysis, a comparison was made between those who died by the same cause, but the manner of death was classified differently. It was found that 99% of suicides and 83% of undetermined cases could be distinguished by three pieces of information: specific causes of death; written or verbal expressions of suicidal intent; and circumstantial evidence suggesting suicide intent. Specifically, all cases whereby the deceased had died from hanging, firearms, explosives, or jumping from a height were classified as suicide. The three cases that deviated from the pattern of decision making involved deaths from poisoning and submersion, alcohol dependent decedents, and decedents who were found to have a positive blood alcohol concentration at the time of autopsy (Lindqvist & Gustafsson, 2002).

Other studies have examined the characteristics that best predict manner of death outcome for specific types of death. Donaldson et al. (2005) used classification and regression tree and random forest analysis, to identify the variables that distinguished suicide poisoning deaths from unintentional poisoning deaths. It was found that suicidal behaviours, alcohol and drug abuse or dependence, physical health problems, depressed mood and age best discriminated between suicide and unintentional poisoning. Specifically, when the deceased was over the age of 47 years old, the determination was more likely to be a suicide, and when the deceased was under the age of 47 years old, the determination was more likely to be accidental death. In addition, random forest analysis also found that the primary poisoning

agent (pharmacy prescription vs other) was a key predictor; with prescription medication the highest amongst suicide cases (Donaldson et al., 2005).

Pamer, Serpi, and Finkelstein (2008) used a similar methodology to Donaldson et al (2002) by utilising classification and regression tree analysis to classify 1,204 undetermined poisoning deaths as unintentional or suicidal poisoning deaths, based on information collected from the National Violent Death Reporting System Public Use Datasets (NVDRS-PUD) and NCHS Vital Statistics Multiple Cause of Death Data (NCHS-MCOD). It was found that the classification and regression tree analysis could differentiate with a high degree of accuracy between the two manner of death types, with the variables of poisoning in the home or workplace, location type where poisoned, place of death, poison type, decedent's age, decedent's race, and year of death; found to be the most important predictor variables. Of the 301 test cases from the sample, only eight were misclassified by the classification and regression tree model (Pamer, Serpi & Finkelson, 2008).

8.2 *Clinical scenarios*

The influences of specific variables on manner of death certification have also been examined by studies that have utilised clinical scenarios and questionnaires. Jarvis et al. (1991) examined inter-examiner variation of manner of death determinations of medical examiners in Canada using fictional scenarios. It was found that gunshot and drug overdose deaths occurred in equal frequency for suicide determinations. More deaths were determined to be accidental when death resulted from drug overdoses compared with gunshots. Contrary to what was hypothesised however, more deaths remained undetermined when death resulted from gunshots compared to drug overdose. Also against the hypothesised outcome, examiners classified significantly more females than males as having died as a result of suicide, with significantly more male deaths than female deaths remaining as undetermined. Finally, post-mortem

evidence indicating the presence of alcohol significantly increased the likelihood of examiners making an accidental death determination (Jarvis et al., 1991).

Similarly, Parai et al., (2006) distributed 14 fictional clinicopathologic scenarios and self-administered questionnaires to coroners in Ontario. Odds ratios of correct manner of death determinations were calculated by using the responses of two deputy chief coroners as the 'gold standard'. It was found that deaths from hanging, drowning and carbon monoxide poisoning had better odds of being classified correctly, whereas deaths resulting from heroin overdose, over-the-counter medication overdose, and injuries sustained by falling from a height decreased the odds of being certified correctly. Scenarios including a prior suicide attempt or a suicide note had greater odds of a correct manner of death determination than scenarios only depicting depression (Parai et al., 2006).

8.3 Summary of predictor variables

In summary, the literature utilising statistical modelling of manner of death determinations and clinical vignettes have consistently shown that cause of death is one of the most significant factors influencing coroners' decision making processes. The presence of an 'active' cause of death, including hanging, jumping, cutting, and gas/car exhaust have been shown to significantly increase the likelihood of a suicide determination being reached (Walsh et al., 1975; Parai et al., 2006; Platt, Backett & Krietman, 1988; Salib, 1996; Salib 1997; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002; Linsley et al., 2001). Platt et al. (1988) found that 88% of active deaths were determined to be a suicide. On the other hand, 'passive' causes of death, including drowning, electrocution, and falling, increased the likelihood of an undetermined or misadventure (i.e., accidental death) verdict (Stanistreet et al., 2001; Walsh et al., 1975; Salib, 1996; Linsley et al., 2001). There is some disagreement over drug related deaths, with some studies finding drug overdoses are more likely to

yield a suicide manner of death determination (Walsh et al., 1975), while others found drug overdoses were more likely to yield accidental death or undetermined manner of death determinations (Jarvis et al., 1991; Lindqvist & Gustafsson, 2002). Similarly, there have been conflicting results for shooting related deaths, with most finding that shooting fatalities were more likely to yield a suicide determination (Platt et al., 1988; Salib, 1996; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002), while others found an undetermined manner of death determination was more likely (Walsh et al., 1975; Salib 1996).

The literature also seems to suggest that intimation of suicidal intent (e.g., leaving a note, telling someone, or having a serious recent suicide attempt) will significantly increase the likelihood that a suicide determination would be returned (Walsh et al., 1975; Salib, 1996; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002; Linsley et al., 2001, Donaldson et al., 2005). However, not all cases where there was evidence of this intent resulted in a suicide determination. For example, Salib (1996) found that where there was evidence of suicide intimation, 23% of cases were undetermined, and 13% were determined to be misadventure.

In regards to other significant predictors, the literature has returned mixed results. Some authors suggest that the presence of alcohol or an alcohol or drug problem significantly predict undetermined and accidental death determinations (Jarvis et al., 1991; Salib, 1996; Donaldson et al., 2005). On the other hand, behavioural change, deliberate self harm, and psychiatric contact (Stanistreet et al., 2001; Salib, 1996; Salib, 1997; Donaldson et al., 2005) have found to be predictors of suicide determinations. Specifically, Salib (1996; 1997) found that having a formal psychiatric history increased the probability of the coroner returning an undetermined finding, whereas having an 'informal' psychiatric condition was more likely to result in a suicide determination. Other studies have found that manner of

death outcomes could not be distinguished by previous psychiatric contact (Platt et al., 1988; Linsley et al., 2001).

In regards to marital status, there has also been some disagreement, with some studies finding that manner of death determinations were unable to be distinguished by marital status (Platt et al., 1988, Linsley et al., 2001), while others finding that single people were more likely to receive a non-suicide determination (Salib, 1996). As for the age of deceased adults, studies have generally found that the younger and older age groups are more likely to receive an undetermined finding. For example, Walsh et al. (1975) found that persons under the age of 40 were significantly more likely to return a determination of suicide than older victims, especially those over the age of 70 years. Similarly, Salib (1996) found that the middle age range (40-50 years) were more likely to result in a suicide determination, while the older cases (50-60 years old) and younger cases (under 30 years) were more likely to return an undetermined finding. This is in contrast to the study by Donaldson et al's (2005) who found that amongst substance related deaths the older age group of decedents (>47 years old) was more likely to attract suicide determinations, while the younger age group (< 47 years old) was more likely to attract an accidental death determination.

Chapter 9. Rationale and Aims of the Current Study

9.2 Summary of the literature and rationale of the current study

As the literature suggests, there is considerable variation in the way deaths are determined and certified by coroners and other authorities. Previous studies have indicated that a proportion of accidental and undetermined deaths may actually be misclassified suicides (Holding & Barraclough, 1975; 1978; Huusko & Hirvonen, 1988; Ohberg & Longvist, 1998). It is also thought that particular types of death are especially prone to inconsistencies and misclassification, including: drug related deaths (Donaldson et al., 2006; Cantor et al. 2001); drowning (Lunetta, et al., 2003; Neeleman & Wessely, 1997; Ohberg & Longvist, 1998); single vehicle fatalities (Schmidt et al., 1977; Connolly et al., 1995; Murray & De Leo, 2007) and child deaths (Hoberman & Garfinkle, 1988; Madge & Harvey, 1999; Gosney & Hawton, 2007).

The factors that may contribute to the apparent variability include: differences in legislative requirements and jurisdictions (Freckelton, 2007; De Leo et al., 2010); differences in definitions, particularly around what constitutes intent (O'Donnell & Farmer, 1995; Timmermans, 2005b; Silverman, 2006); the amount of evidence required (O'Carroll, 1989; Litman et al., 1963; Farberow, et al.,1977; Carpenter & Tait 2010); a death certifier's level of experience (Parai et al., 2006; Smithey & Ramirez, 2004); and whether the certifier comes from a legal or clinical background. Furthermore, it has been suggested that manner of death determinations may be influenced by factors external to the investigative process, including: beliefs around children and suicide (Mishara, 1999; Crepeau-Hobson, 2010); social and familial pressures due to the perceived stigma attached to suicide (Rudestam & Imbrol, 1983; Calhoun et al., 1993); religious, cultural and racial factors (Jarvis et al.,

1991; Domino & Leenaars, 1995; Warshauer & Monk, 1978; Rockett et al., 2006); and a natural susceptibility to biases and heuristics.

Considering this variation, it is important to understand which factors a coroner considers to be the most important when reaching manner of death determinations. Researchers have consistently suggested that that variables such as cause of death (Walsh, et al. 1975; Parai et al., 2006; Platt, et al., 1988; Salib, 1996; Salib 1997; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002; Linsley, et al., 2001), intimation of suicide intent, such as leaving a suicide note (Walsh et al., 1975; Salib, 1996; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002; Linsley et al., 2001, Donaldson et al., 2005) and age of the deceased (Walsh et al., 1975; Salib, 1996) are significant predictors of manner of death determinations. However, results have been mixed when attempting to identify the ability of other factors to distinguish between different manner of death determinations, e.g., the deceased having a psychiatric history (Stanistreet et al., 2001; Salib, 1996; 1997; Platt, et al., 1988; Linsley, et al., 2001).

There are currently no standardised guidelines or set criteria that coroners use within Australia to assist them in their decision making processes. The lack of agreed standards of investigation, data collection, analysis and processes for different manner of death determinations increases the likelihood of inconsistent findings (Freckelton & Ranson, 2006). Accurate manner of death determinations are extremely important. In particular, knowing true rates of suicide deaths is crucial in identifying high risk groups and targeting preventative programs and interventions to those groups (Rosenberg et al., 1988).

The current study was devised in light of the literature regarding the apparent inconsistencies in coronial decision-making processes, and the lack of standardised guidelines. Furthermore, given that a great deal of the previous literature on coroners

(and the need for reforms) has largely been from a legal perspective, more empirical data on coronial decision making is required. This study expanded upon studies by Walsh et al. (1975), Salib (1996), Salib (1997), Stanistreet et al. (2001), Lindqvist and Gustafsson (2002), Parai et al. (2006), and Robertson and Crawley (2009), which identified predictor variables and/or used statistical modelling to identify discrepancies in manner of death determinations made in Britain, Ireland, Canada and Sweden. The current study used a similar statistical approach to conduct exploratory research in the context of the Australian coronial and policing system. It also investigated the role of police and pathologist hypotheses of manner of death in equivocal cases (and consistency with coroners' determinations), an area that has not been investigated in any great depth by the previous literature.

9.2 Aims of the current study

The first aim of the study was to conduct a retrospective analysis of coroner files in order to explore which variables best predict coronial determinations of suicide, accidental death, homicide and undetermined manner of death. By identifying these variables a classification tree model was developed for each manner of death outcome. The second aim of the current study was to use these models to identify discrepancies between statistically predicted outcomes, and observed outcomes of coronial determinations (suicide/homicide/accident/undetermined) in cases of equivocal death.

Based on previous research, it was hypothesised that cause of death, previous psychiatric contact, presence of a suicide note, and age of the deceased would be significant statistical predictors of manner of death outcomes. Specifically, an active cause of death (e.g., asphyxia), having a formal history of mental illness, and the presence of a suicide note will predict suicide determinations. A passive cause of death (e.g., substance related), absence of a formal history of mental illness and no

suicide note will predict accident and undetermined outcomes. Furthermore, given the literature around the potential misclassification of child deaths, it is also hypothesised that the older the deceased (>18 years) the more likely the death will be predicted to be a suicide determination, while the younger the deceased (<18 years) the more likely the death will be predicted to be an accidental death or undetermined. While it has not been explored by the previous research, it is could be reasonably expected that the police and coroners will have similar views around manner of death determinations, given that they both consider the same evidence during investigations of equivocal death. Therefore, it also hypothesised that the police hypotheses of manner of death will significantly predict each respective manner of death outcome (e.g., a police hypothesis of suicide would significantly predict a coronial determination of suicide).

Secondly, it was hypothesised that there would be a less than 100% match between coroners' statistically predicted determinations in cases of equivocal death, and the observed determinations. For example, it was expected that some cases would have received a coronial manner of death determination of 'accidental death' or 'undetermined manner of death', while the statistical model predicted it to be a 'suicide'. Due to its generally unequivocal nature, no discrepancies between predicted and observed outcomes were expected in cases of homicide.

Chapter 10. Method

10.1 Participants

One hundred and eleven closed files were selected by searching the National Coronial Information System (NCIS) for cases of deaths from 'unnatural' causes. Cases were selected from a single state of Australia within a discrete timeframe. To protect the confidentiality of the deceased, the time period and location will remain undisclosed. Two cases were excluded from the final analysis because the full file could not be obtained. Cases were selected to provide a relatively equal representation of each type of manner of death determination, with the most recent cases (at the time of data collection) preferred. However, it should be noted that the number of cases selected were limited because they were obtained from a relatively small jurisdiction.

While the exact timeframe cannot be disclosed, it can be confirmed that most cases were taken within a five year time period, and only involved decisions made by coroners who were practicing at the time of data collection. Furthermore, all but one of the cases was from the time that the NCIS had been initiated, and the files were only selected if they were formatted in a similar manner. These measures were taken in an effort to ensure that the habits of the coroners and police officers under investigation did not vary considerably, and therefore potentially skew the results.

The final sample (n=109) included 29 cases where the final determination was suicide, 36 cases determined to be accident, 22 cases determined to be homicide, and 22 cases that were undetermined. In total, the cases involved eight different presiding coroners.

10.2 Procedure

10.2.1 Pilot Study

One case was randomly selected from each of the four manner of death determination types (suicide / accident / homicide / undetermined). The evidentiary information listed in the coroners' reports was compared to the total evidence information contained within the entire coronial file. The outcome of this initial phase was to indicate whether it was necessary to view the entire file or whether it was sufficient to only examine the coroner's report for each case, and to gain an indication of the type of variables examined during coronial decisions. It was deemed necessary to review the entire coronial file to gather all of the information required.

10.2.2 Main Study

The coronial file for each of the 109 cases of equivocal death was reviewed. This review process involved recording information about the case and identifying the presence or absence of pre-determined demographic and evidentiary variables. Individual cases where coroners' determinations did not match the statistically predicted manner of death were identified and thus determined as representing evidence/determination discrepancies. Due to the high number of predictor variables and small number of cases, some of the variables needed to be combined. For example, 'asphyxia related' deaths included hanging, drowning and choking. Specific variables from this data survey were purposefully excluded from the analysis due to the possibility of a subjective interpretation (e.g., "Presence of future plans") or difficulty collecting or classifying information (e.g., "Activity at the time of death"). These variables will be addressed in the descriptions of discrepant cases.

Furthermore, due to the sparse and inconsistent information about whether the deceased was Aboriginal, a Torres Strait Islander or a migrant (or if there were any other cultural issues present), this information was not coded for analysis.

However, this information is noted in the descriptions of discrepant cases where applicable. The work-status of students was classified as 'employed'. The variable 'Negative mood or significant stressors prior to death' was considered 'present' if the last known mood state of the deceased was negative (e.g., depressed, agitated, psychotic, erratic, withdrawn etc.). Or in the absence of this information, whether there was a factor considered to be a stressor to the deceased at the time of their death (e.g., a relationship breakdown, death of a loved one, financial difficulties, work stress etc.). If any information was unknown or not available in any category, it was deemed to be not specified.

10.3 Design

The study utilized a retrospective survey approach. The continuous independent variable was age. The categorical independent variables (based on typical elements of case evidence) are shown later in Table 1. The dependent variables were the manner of death determination categories (suicide / homicide / accident / undetermined).

10.4 Statistical Analysis

The analysis was exploratory in nature because its main goal was to discern relationships, rather than to test any *a priori* theories or hypotheses. Variables were based on those factors known to be associated with manner of death determinations. They were selected based on the predictor variables identified in previous research (Robertson & Crawley, 2009; Stanistreet, et al., 2001; Salib, 1996) and following the file review conducted during the pilot phase of the study. All of the categorical variables were dummy coded (i.e., as either 0 or 1). This was done to ensure all variables were binary, and therefore simplified the interpretation process.

Two different but complimentary types of statistical analysis were utilised to explore the data, including binary logistic regression, and classification and

regression trees. A similar analysis was used by Steadman et al. (2000) who took a classification tree approach in order to formulate an actuarial violence risk assessment tool, and Camdeviren, Yazici, Akkus, Bugdayci and Sungur (2007) who compared the two methods to explore the social-demographic risk factors in postpartum depression. Due to the statistical limitations in applying logistic regression alone, the results from the logistic regression models will only be used to confirm the results from the classification tree models. Thus, the classification tree models will form the main basis for identifying discrepant cases (and supersede the logistic regression results).

Chapter 11. Results

11.1 Logistic regression overview and results

During the first part of the analysis, a series of binary logistic regression analyses were conducted using SPSS 17.0. This was done to identify significant predictors in coronial manner of death determinations and to develop a model that can correctly predict the category of outcome for individual cases. In order to develop the most parsimonious model (the greatest explanatory power from the fewest variables), a number of steps were taken.

Firstly, all of the variables were entered into the analysis using a forced entry method. This yielded a Roa's efficiency score for each variable, which tests whether the coefficient value for each variable is significantly different from zero (Field, 2005). The significant predicator variables ($p<.05$) were identified for each manner of death determination. The significant predictor variables were entered into another analysis using backwards stepwise removal. Backward stepwise regression is the preferred method of exploratory analyses, where the analysis begins with a full or saturated model and variables are eliminated from the model in an iterative process. The likelihood ratio (LR) statistic was used to estimate how well the final model fitted the observed data. LR was chosen instead of Wald statistic, due to the Wald statistic's susceptibility to making type II errors with smaller samples. This process was repeated for each of the manner of death determinations.

The results for each manner of death determination type (suicide / accident/ homicide / undetermined) will be discussed in turn. It is important to note that if the *absence* of a particular variable is found to make a significant contribution to the logistic regression model, this exp *b* value must be inverted (i.e., 1 divided by the exp *b* value) in order to calculate and describe an odds ratio greater than 1. Information

about the characteristics and descriptive statistics of the variables, including frequencies, and mean age (SD) are shown in Table 1.

Table 1.

Descriptive statistics of variables according to manner of death determination (number (%) or mean +/- SD).

Variable	Suicide (n= 29)	Accident (n=36)	Homicide (n=22)	Undetermined (n=22)	Total (n=109)
Age	47.17 (15.86)	49.45 (23.41)	44.32 (24.60)	43.32 (17.41)	46.57 (20.63)
Police hypothesis					
- Suicide	29 (100%)	1 (2.78%)	0 (0%)	6 (27.27%)	36 (33.03%)
- Accident	0 (0%)	15 (41.67%)	0 (0%)	5 (22.73%)	20 (18.35%)
- Homicide	0 (0%)	0 (0%)	22 (100%)	1 (4.55%)	23 (21.10%)
- Natural	0 (0%)	3 (8.33%)	0 (0%)	2 (9.09%)	5 (4.59%)
- Undetermined	0 (0%)	17 (47.22%)	0 (0%)	8 (36.36%)	25 (22.94%)
Pathologist hypothesis					
- self inflicted	8 (27.59%)	0 (0%)	0 (0%)	2 (9.09%)	10 (9.17%)
- not self inflicted/ not specified	21 (72.41%)	36 (100%)	22 (100%)	20 (90.91%)	99 (90.83%)
Gender					
- Male	22 (75.86%)	24 (66.7%)	13 (59.09%)	10 (45.45%)	69 (63.30%)
- Female	7 (24.14%)	12 (33.3%)	9 (40.91%)	12 (54.55%)	40 (36.70%)
Marital status					
- Never married/ single	8 (27.59%)	14 (38.89%)	11 (50%)	11 (50%)	44 (40.37%)
- De-facto/married	8 (27.59%)	14 (38.89%)	8 (36.36%)	7 (31.82%)	37 (33.94%)
- Separated/ divorced/widowed	13 (44.83%)	8 (22.22%)	3 (13.64%)	4 (18.18%)	28 (25.69%)
Employment status					
- Employed/student	13 (44.83%)	12 (33.33%)	8 (36.36%)	4 (18.18%)	37 (33.94%)
- Unemployed	16 (55.17%)	24 (66.67%)	14 (63.64%)	18 (81.82%)	72 (66.06%)
Place of death					
- Within home	19 (65.52%)	20 (55.56%)	14 (63.64%)	12 (54.55%)	65 (59.63%)
- Outside of home	10 (34.48%)	16 (44.44%)	8 (36.36%)	10 (45.45%)	44 (40.37%)
Cause of death					
- substance related (drug /alcohol)	4 (13.79%)	16 (44.44%)	0 (0%)	10 (45.45%)	30 (27.52%)
- asphyxia related (hanging/drowning/ choking)	14 (48.28%)	6 (16.67%)	1 (4.55%)	0 (0%)	21 (19.27%)
- blunt trauma (blunt instrument/motor vehicle crash/fall)	2 (6.90%)	11 (30.56%)	9 (40.91%)	6 (27.27%)	28 (25.69%)
- gunshot/stabbing	6 (20.69%)	2 (5.56%)	9 (40.91%)	0 (0%)	17 (15.60%)

Table 1. (cont.)

Cause of death (cont.)					
- other (CO poisoning/fire related)	3 (10.34%)	0 (0%)	2 (9.09%)	0 (0%)	5 (4.59%)
- undetermined	0 (0%)	1 (2.77%)	1 (4.55%)	6 (27.27%)	8 (7.34%)
Presence of alcohol					
- Yes	10 (34.48%)	8 (22.22%)	8 (36.36%)	6 (27.27%)	32 (29.36%)
- No/not specified	19 (65.52%)	28 (77.77%)	14 (63.64%)	16 (72.73%)	77 (70.64%)
Presence of illicit - drugs					
- Yes	24 (82.76%)	4 (11.11%)	5 (22.73%)	5 (22.73%)	19 (17.43%)
- No/not specified	5 (17.24%)	32 (88.89%)	17 (77.27%)	17 (77.27%)	90 (82.57%)
Presence of prescription medication					
- Yes	18 (62.07%)	31 (86.11%)	10 (45.45%)	18 (81.82%)	77 (70.64%)
- No/not specified	11 (37.93%)	5 (13.89%)	12 (54.55%)	4 (18.18%)	32 (29.36%)
Presence of suicide note					
- Yes	11 (37.93%)	0 (0%)	0 (0%)	0 (0%)	11 (10.09%)
- No/not specified	18 (62.07%)	36 (100%)	22 (100%)	21 (100%)	98 (89.91%)
Previous self harm (including suicide attempts)					
- Yes	14 (48.28%)	4 (11.11%)	3 (13.64%)	9 (40.91%)	30 (27.52%)
- No/not specified	15 (51.72%)	32 (88.89%)	19 (86.36%)	13 (59.09%)	79 (72.48%)
Recent suicide threats or chronic ideation					
- Yes	9 (31.03%)	3 (8.33%)	1 (4.55%)	3 (13.64%)	16 (14.68%)
- No/not specified	20 (68.97%)	33 (91.67%)	21 (95.45%)	19 (86.36%)	93 (85.32%)
History of a mental illness (formal)					
- Yes	18 (62.07%)	19 (52.78%)	3 (13.64%)	15 (68.18%)	55 (50.46%)
- No/not specified	11 (37.93%)	17 (47.22%)	19 (86.36%)	7 (31.82%)	54 (49.54%)
Current medical condition					
- Yes	9 (31.03%)	23 (63.89%)	7 (31.82%)	17 (77.27%)	56 (51.38%)
- No/not specified	20 (68.97%)	13 (36.11%)	15 (68.18%)	5 (22.73%)	53 (48.62%)
Evidence of negative mood/significant stressors					
- Yes	28 (96.55%)	10 (27.78%)	10 (45.45%)	18 (81.82%)	66 (60.55%)
- No/not specified	1 (3.45%)	26 (72.22%)	12 (54.55%)	4 (18.18%)	43 (39.45%)

11.2 Suicide determinations

The variables which made a significant individual contribution to predicting coronial determinations of suicide (i.e., have a significant Roa's efficiency score) are shown in Table 2.

Table 2.

Variables which make a significant contribution to coroner's manner of death determinations of suicide based on significant Roa's efficiency scores.

Variable	Roa's efficiency score	df	Sig*
Suicide note	33.751	1	.000
Medical condition	6.545	1	.011
History of self harm (including suicide attempts)	8.531	1	.003
Suicide threats or chronic ideation	8.439	1	.004
Negative mood/significant stressors prior to death	21.439	1	.000
Pathologist hypothesis	16.075	1	.000
Police hypothesis - accident	8.879	1	.003
Police hypothesis – suicide	80.123	1	.000
Police hypothesis – homicide	10.567	1	.001
Police hypothesis - undetermined	11.760	1	.001
Relationship status – separated/divorced/widowed	7.582	1	.006
Cause of death – blunt trauma	7.309	1	.007
Cause of death – asphyxia related	21.378	1	.000

*Note: $p<0.05$

The variables that have a significant Roa's efficiency score were entered into a backwards stepwise (Wald) analysis to determine which combination of variables

best predicted suicide as the manner of death. A number of variables produced inflated Standard Error (SE) scores, which did not allow the model from reaching a final solution. These variables included the presence of a suicide note, and police hypotheses for accident, homicide, and suicide. The presence (or absence) of these variables produce inflated SEs because of their tendency to perfectly predict the outcome variable (also referred to as 'complete separation'; Field, 2005). Due to statistical limitations of including these variables in the analysis, they were removed from the model and it was run again. The final predictor variables that made a significant contribution to the logistic regression model for suicide determinations are shown in Table 3. As can be seen, when there was the presence of a negative mood state (or significant stressors) prior to death, the coroner was 55 times more likely to rule the death as a suicide (exp b = 55.328). Finally, when the cause of death was asphyxia related the coroner was 18 times more likely to determine the death as a suicide (exp b = 18.882). Overall, this model correctly classified 85.3% of the cases.

Table 3.

Significant predictor variables included in the logistic regression model for cases predicted to be suicide.

Predictor Variables	B(SE)	Wald	p	95% CI for exp b (odds ratio)		
				Lower	exp b	Upper
Negative mood/significant stressors prior to death	4.013 (1.184)	11.484	.001	5.431	55.328	563.624
Cause of death – asphyxia related	2.938 (.810)	13.161	.000	3.860	18.882	92.353
Constant	-4.914 (1.194)	16.930	.000	-	.007	-

Sixteen cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The logistic regression

model predicted one case to be a suicide (when the coroner determined that this case was something else), and 15 cases to be accident, homicide or undetermined, when the coroner determined them to be a suicide.

11.3 Accidental death determinations

The variables which made a significant individual contribution to predicting coronial determinations of an accidental death are shown in Table 4.

Table 4.

Variables which make a significant contribution to coroner's manner of death determinations of an accidental death based on significant Roa's efficiency scores.

Variable	Roa's efficiency score	Df	Sig*
Prescription medicine	6.202	1	.013
Suicide note	6.034	1	.014
History of self harm (including suicide attempts)	7.258	1	.007
Negative mood/significant stressors prior to death	24.170	1	.000
Pathologist hypothesis	5.430	1	.020
Police hypothesis – accident	19.508	1	.000
Police hypothesis – suicide	22.237	1	.000
Police hypothesis – homicide	14.376	1	.000
Police hypothesis – undetermined	17.938	1	.000
Cause of death – substance related	7.716	1	.005
Cause of death – stab/gunshot	4.117	1	.042

*Note: $p<0.05$

The variables with a significant Roa's efficiency score were entered into a backwards stepwise (LR) analysis to determine which combination of variables best predicted accident as the manner of death. Suicide note, pathologist hypothesis and

police hypothesis of homicide had to be removed from the analysis because the presence or absence of these variables were 'perfect predictors' for a coroner's determination of an accidental death. The final predictor variables that made a significant contribution to the logistic regression model for accidental death determinations are shown in Table 5. As can be seen, the presence of a police hypothesis of an accidental death made the greatest predictive contributions to the model. It resulted in a coroner being 13 times more likely to determine the death to be an accident (exp b = 13.204). Similarly, the presence of a police hypothesis of undetermined resulted in a coroner being almost 40 times more likely to determine the death to be an accident (exp b = 39.540). The absence of a negative mood state or significant stressors prior to death also increased the likelihood that the death would be deemed to be an accident by the coroner (37 times more likely, *exp b* = 37.132). If the death was substance related, the coroner was also seven times more likely to determine that the death was an accident (*exp b* = 7.015). Overall, this model correctly classified 89% of the cases.

Twelve cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The logistic regression model predicted eight cases to be an accident (when the coroner determined that they were something else), and four cases to be suicide, homicide or undetermined, when the coroner determined them to be an accident.

Table 5.

Significant predictor variables included in the logistic regression model for cases predicted to be an accidental death.

Predictor variables	B(SE)	Wald	*p*	95% CI for exp *b* (odds ratio)		
				Lower	exp *b*	Upper
Negative mood/significant stressors prior to death	-3.614 (.949)	14.519	.000	5.785	37.132	238.336
Police hypothesis – Accident	4.795 (1.130)	18.013	.000	13.204	120.871	1106.464
Police hypothesis – Undetermined	3.677 (.940)	15.300	.000	6.263	39.540	249.616
Cause of death – substance related	1.948 (.860)	5.129	.024	1.300	7.015	37.858
Constant	-5.502 (1.156)	22.646	.000	-	.004	-

11.4 Homicide determinations

The variables which made a significant individual contribution to predicting coronial determinations of homicide are shown in Table 6.

The variables with a significant Roa's efficiency score were entered into a backwards stepwise (LR) analysis to determine which combination of variables best predicted homicide as the manner of death. Police hypotheses of homicide, accident, suicide and undetermined, and cause of death (substance related) had to be removed from the analysis because the presence or absence of these variables were 'perfect predictors' for a coroner's determination of homicide. The final predictor variables that made a significant contribution to the logistic regression model for homicide determinations are shown in Table 7. As can be seen, the absence of a history of mental illness, resulted in the coroner being eight times more likely to determine the death as a homicide (exp *b* = 8.368). If the cause of death was stabbing or gunshot

related, the coroner was almost six times more likely to determine the death as a homicide (exp $b = 5.714$). Overall, this model correctly classified 83.5% of the cases.

Eighteen cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The logistic regression model predicted 14 cases to be a homicide (when the coroner determined that they were something else), and four cases to be suicide, accident or undetermined, when the coroner determined them to be a homicide. However, it needs to be noted that a police determination of homicide is an almost perfect predictor for coronial determinations of homicide, and correctly accounts for all but one of the cases reviewed.

Table 6.

Variables which make a significant contribution to coroner's manner of death determinations of a homicide based on significant Roa's efficiency scores.

Variable	Roa's efficiency score	Df	Sig*
Prescription medication	8.432	1	.004
History of mental illness	14.950	1	.000
Medical condition	4.221	1	.040
Police hypothesis - undetermined	8.203	1	.004
Police hypothesis – accident	6.194	1	.013
Police hypothesis – suicide	13.593	1	.000
Police hypothesis – homicide	103.062	1	.000
Cause of death – substance related	10.467	1	.001
Cause of death – stab/gunshot	13.416	1	.000
Cause of death – asphyxia related	3.840	1	.050

*Note: $p<0.05$

Table 7.

Significant predictor variables included in the logistic regression model for cases predicted to be a homicide.

Predictor Variables	B(SE)	Wald	*p*	95% CI for exp *b* (odds ratio)		
				Lower	exp *b*	Upper
History of mental illness	2.124 (.678)	9.810	.002	2.215	8.368	31.618
Cause of death – stab/gunshot	1.743 (.625)	7.776	.005	1.679	5.714	19.452
Constant	-3.164 (.631)	25.107	.000	-	.042	-

11.5 Undetermined manner of death determinations

The variables which made a significant individual contribution to predicting coronial decisions where manner of death remained undetermined are shown in Table 8.

Table 8.

Variables which made a significant contribution to coroner's manner of death decisions remaining undetermined based on significant Roa's efficiency scores.

Variable	Roa's efficiency score	df	Sig*
Medical condition	7.400	1	.007
Negative mood/significant stressors prior to death	5.219	1	.022
Police hypothesis – homicide	4.538	1	.033
Cause of death – substance related	4.443	1	.035
Cause of death – stab/gunshot	5.093	1	.024
Cause of death – asphyxia related	6.578	1	.010

*Note: $p<0.05$

The variables with a significant Roa's efficiency score were entered into a backwards stepwise (LR) analysis to determine which combination of variables best predicted undetermined as the manner of death. A number of the cause of death variables (including stabbing or gunshot, and asphyxia-related) were perfect predictors, so they were removed from the analysis. The final predictor variables that made a significant contribution to the logistic regression model for undetermined manner of death are shown in Table 9. As can be seen, the presence of a negative mood state or significant stressor prior to death made it four times more likely that the coroner would declare the case to be undetermined (*exp b* = 4.215). If a medical condition was present, the coroner was almost five times more likely to declare the death as undermined (*exp b* = 4.717). Overall, this model correctly classified 79.8% of the cases.

Table 9.

Significant predictor variables included in the logistic regression model for cases predicted to be undetermined.

Predictor variables	B(SE)	Wald	*p*	95% CI for Exp *b* (odds ratio)		
				Lower	Exp *b*	Upper
Medical Condition	1.551 (.569)	7.439	.006	1.547	4.717	14.379
Negative mood/significant stressors prior to death	1.439 (.613)	5.501	.019	1.267	4.215	14.022
Constant	-3.334 (.706)	22.320	.000	-	.036	-

Twenty two cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The logistic regression model predicted all of these cases to be either a suicide, homicide or an accidental death, when the coroner declared them to be undetermined.

11.6 Classification tree overview and results

Classification trees involve splitting data into subgroups in order to improve the prediction or classification of a target (dependent variable). It starts with the single predictor variable at the root of the tree, and then recodes or groups this value into at least two nodes, forming a new 'branch' on the tree. With each branch, the process starts again with the algorithm looking for the best predictor amongst a set of variables, and creating at least two nodes with that predictor. When no more predictor variables are found that can improve the accuracy of the prediction, the tree stops growing. The first node where the division starts is called the family node, the nodes which continue division are called child nodes, and the nodes where the division finish or homogeneity occurs are called terminal nodes (Camdeviren et al., 2007).

Classification trees have been cited repeatedly as a powerful nonparametric approach in applied fields where classification or prediction are of concern, such as medicine (Briollais et al., 2007), risk assessment (Steadman, et al., 2000), academic performance (Vandamme, Meskens & Superby, 2007), and mental health (Camdeviren et al., 2007). They have also been used to identify predictor variables that best distinguish between different manner of death determinations (Donaldson et al., 2005; Pamer, 2008). Classification trees have a number of advantages over other methods, including: being able to analyse a large number of predictor variables; being able to deal effectively with large data sets and the issues of high dimensionality; handling mixed variables (continuous and discrete); generating rules that are relatively easy to interpret and understand (Ding & Simonoff, 2010), and they do not make any assumptions about the distributions of the variables, that normally affect parametric procedures (Albayrak, 2009).

The classification tree analysis used in the current study was conducted on Statistica 7.0. In the process of computing classification trees, a number of steps need to be taken, including: selecting splits; determining when to stop splitting; and choosing the 'right sized tree'. In this study, the chosen method for selecting splits was the Classification and Regression Tree (C&RT) style exhaustive search for univariate splits. With this method, all possible splits for each predictive variable at each node are examined to find the split producing the largest improvement in the goodness of fit. Chi Square was chosen as the goodness of fit measure in the splitting process, while misclassification costs for each class were set to estimated values. In determining when to stop splitting and selecting the "right sized" tree structure, a minimal cost-complexity approach was undertaken. This is where measures of cost (i.e., the degree of misclassification) and complexity (i.e., the number of nodes) need to be balanced and minimum. When these conditions are balanced, the predictive accuracy of the tree increases. Breiman, Friedman, Olshen and Stone (1984) advises that in order to do this, the smallest-sized (least complex) tree whose Cross Validation (CV) costs do not differ appreciably from the minimum CV costs, should be selected. The specific stopping rule and pruning method chosen was 'Prune on Misclassification Error'. The final tree will be the one whereby the re-substitution cost value is the nearest one to the CV cost, plus or minus one standard error boundary.

For each manner of death outcome, two C&RT models were produced. The first tree for each determination type included all of the variables (C&RT - A). Any observed cases which were misclassified by this initial model were identified as 'discrepant', and are described in turn. The second tree repeated this process, but with the 'Police Hypothesis' variables removed (C&RT - B). This was done due to the known strength of these variables as predictors (as identified by the logistic

regression results), and the interest in knowing other variables which are important in a coroner's decision. The manner in which these C&RT results are presented follows the same format utilised by Camdeviren et al. (2007). Each node shows the predicted outcome and number of cases present following each division (N), and the histogram depicts the number of cases where the variable was observed to be present (i.e., bar is above the line) or absent (i.e., bar is below the line).

11.7 Suicide determinations

11.7.1 Suicide C&RT - A

The optimal tree structure for suicide determinations following pruning was tree 2 (refer to Table 10).

Table 10.

Cost complexity measures of the C&RT for predicting a coroners' determination of suicide (all variables).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1	6	0.064220	0.023481	0.027523	0.000000
2*	**2**	**0.064220**	**0.023481**	**0.064220**	**0.009174**
3	1	0.266055	0.042326	0.266055	0.201835

Note: ***bolded text**=optimal tree

As can be seen in Figure 1, the first and only split in the tree was for police hypothesis of suicide. This indicates that a police hypothesis that the death was a suicide was the most powerful variable in predicting a suicide determination by the coroner.

The C&RT model correctly identified 93.58% of cases (refer to Table 11). Seven cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The model predicted all of these cases to be a suicide (when the coroner determined that they were either an accident, homicide, or undetermined).

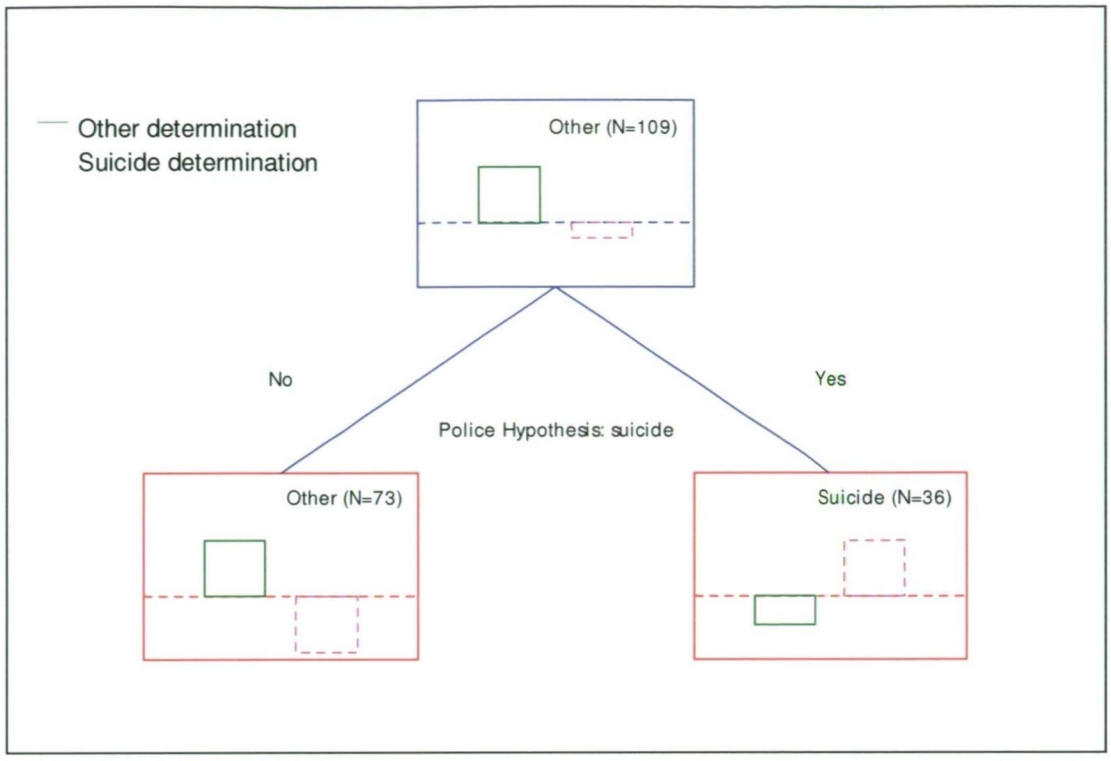

Figure 1. Classification tree for predicted coroner manner of death for suicide determinations: all variables.

Table 11.

Classification table for suicide determinations (all variables) based on the optimal tree.

Predicted	Observed		Total
	Other determination	Suicide determination	
Other determination	73	0	83
Suicide determination	7	29	36
Total	80	29	109

Specificity: 81.11% (=73/90). Sensitivity: 100% (=29/29). Re-substitution cost: 6.42% [=(0+7)/109]. Total accuracy rate: 93.58% [=(73+29)/109].

10.7.2 Suicide C&RT - B

When the police hypotheses variables were removed, the optimal tree structure following pruning was tree 2 (refer to Table 12).

Table 12.

Cost complexity measures of the C&RT predicting a coroners' determination of suicide (all variables, excluding police hypotheses).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1	8	0.119266	0.031043	0.045872	0.000000
2*	**4**	**0.100917**	**0.028852**	**0.082569**	**0.009174**
3	2	0.165138	0.035565	0.165138	0.041284
4	1	0.266055	0.042326	0.266055	0.100917

Note: ***bolded text***=optimal tree

The first split was for the presence of a suicide note. The second split was if cause of death was asphyxia related. The final split was if a negative mood state or significant stressors prior to death was present. Refer to Figure 2.

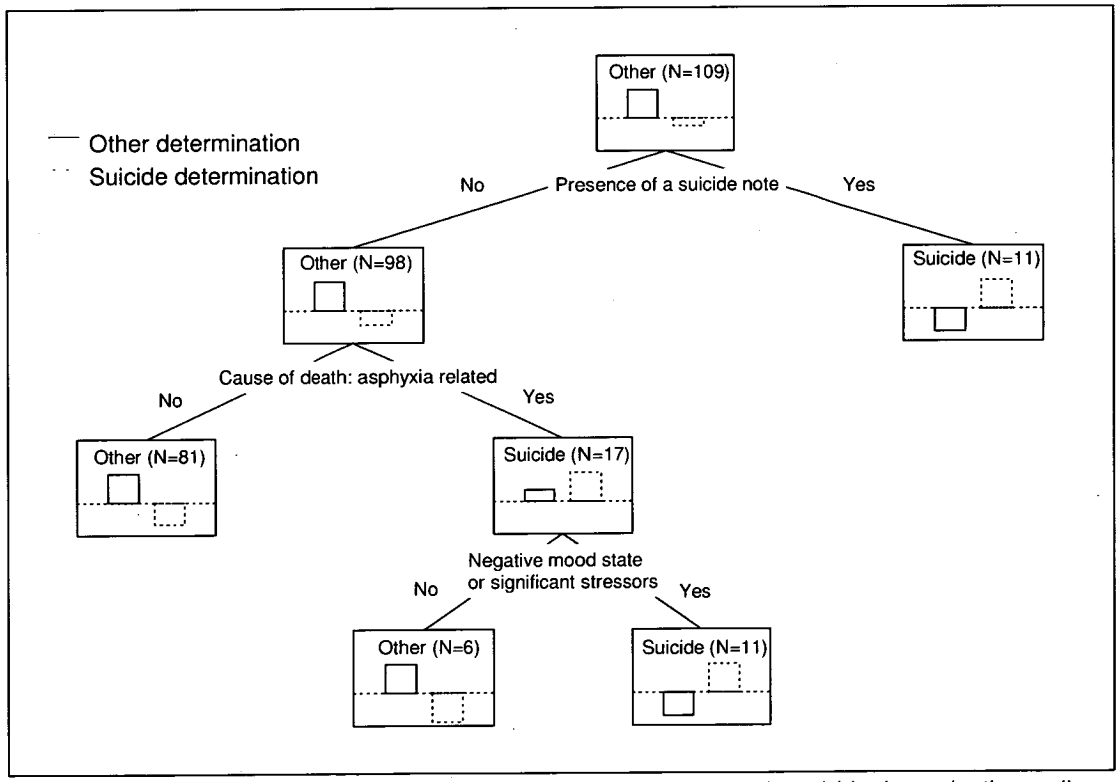

Figure 2. Classification tree for predicted coroner manner of death for suicide determinations: all variables, excluding police hypotheses.

The C&RT model correctly identified 91.74 % of cases (refer to Table 13). Nine cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The C&RT model predicted one of these cases to be a suicide (when the coroner determined that they were an accident, homicide, or undetermined), and eight cases to be accident, homicide or undetermined, when the coroner determined that they were suicide.

Please note that a classification table for predicted determinations (based on the suicide C&RT – B) against observed police hypothesis for suicide cases can be found in the Appendix.

Table 13.

Classification table for suicide determinations (all variables, excluding police hypotheses) based on the optimal tree.

Predicted	Observed		Total
	Other determination	Suicide determination	
Other determination	79	8	87
Suicide determination	1	21	22
Total	80	29	109

Specificity: 87.78% (=79/90). Sensitivity: 72.41% (=21/29). Re-substitution cost: 8.26% [=(8+1)/109]. Total accuracy rate: 91.74% [=(79+21)/109].

10.7.3 Discrepant cases

The following cases are those in which the observed outcome did not match what was predicted for suicide determinations based on C&RT - A (all variables).

Case 4.

The deceased was a 13 year old boy who had been diagnosed with ADHD. The cause of death was asphyxia as a result of hanging from his bunk bed by a piece of cord. The deceased did not have a history of self harm or suicide attempts, but had recently threatened to kill himself. He was reportedly in a jovial and happy mood just

prior to his death, but had demonstrated a recent increase in aggressive and violent behaviour. The toxicology report found that only prescription drugs were present in his system at the time of death. No suicide note was present. The police hypothesis was that the death was a suicide. The coroner determined Case 4 to be an accident, but the C&RT model predicted it to be a suicide.

Case 22.

The deceased was a 43 year old divorced unemployed female, with a history of depression and self harm. The cause of death was head injuries as a result of a cliff fall. Just prior to her death, the deceased engaged in agitated and bizarre behaviour, including burning her car. She had also just been to the supermarket, and had attended a job interview. At the time of her death, razor blades were in the deceased's pocket, and there were recent cuts on her arm. The toxicology report did not find any substances present. The police hypothesis was that the death was a suicide. The coroner declared Case 22 to be undetermined, but the C&RT model predicted it to be a suicide.

Case 87.

The deceased was a 56 year old, single unemployed male, with a history of depression and narcissistic personality disorder. The deceased was found in the bath, but cause of death could not be determined due to the significant decomposition of the body. The toxicology report found the presence of non-fatal levels of prescription medication. Due to the decomposition of the body, the presence of ethanol could not be determined. However it was strongly suspected that alcohol was consumed prior to death due to empty alcohol bottles present near the deceased's body. The deceased had a history of suicide attempts and self harm, and chronic suicidal ideation. He had recently updated his will. He was reportedly angry, argumentative, and socially withdrawn just prior to his death. The police hypothesis

was that the death was a suicide. The pathologist stated that the evidence "strongly suggests suicide as the manner of death". The coroner declared Case 87 to be undetermined, but the C&RT model predicted it to be a suicide.

Case 96.

The deceased was a 21 year old, single unemployed male who was living in a residential facility. He was found deceased in his bed from a combined drug intoxication. The pathology report found the presence of marijuana, and at least four different types of prescription medications, including fatal levels of Tramadol and Olanzapine. The pathology report also found that the deceased had hepatitis C, and brain damage caused by chronic drug use. The deceased had a long history of mental health issues and diagnoses, including drug induced psychosis, antisocial/borderline personality disorder, schizophrenia and drug abuse. He also had a history of self harm, suspected suicide attempts, and previous suicide threats (but not recently). Just prior to his death, it was reported that he was increasingly violent, aggressive, depressed, and under the influence of drugs. While there were no reports of significant future plans, he had reportedly requested a hot meal for when he woke up. The police hypothesis was that the death was a suicide. The coroner declared Case 96 to be undetermined, but the C&RT model predicted it to be a suicide.

Case 97.

The deceased was a 41 year old unemployed woman who was in a de facto relationship at the time of her death. She died in her bedroom from multiple drug toxicity. The pathology report found the presence of at least six types of prescription medications, but none of which were at fatal levels. The deceased had hepatitis C, and was considered obese. She had a history of depression, substance abuse, and panic disorder. She had a history of previous suicide threats, and reports of some recent suicidal ideation. Just prior to her death, she was described as depressed,

unwell, and fearful that she had cancer. The initial police hypothesis was that the manner of death was 'unknown'. However, following a more thorough investigation and report, the police stated that the death was suicide. The pathologist's opinion was that it was a "self inflicted act". The coroner declared Case 97 to be undetermined, but the C&RT model predicted it to be a suicide.

Case 105.

The deceased was a 39 year old single female, employed as a shop assistant. She died as a result of multiple injuries from being hit by a motor vehicle. The pathology report found that she had alcohol in her system and at least three types of prescription medication (including methadone) all at therapeutic levels. She had a history of substance abuse, drug induced psychosis, depression and PTSD. She had recently had a hip replacement, and suffered from chronic pain. She had a history of suicide threats. There were reports that she had plans to take a trip interstate to visit her mother. The police hypothesis was that the death was a suicide. The coroner declared Case 105 to be undetermined, but the C&RT model predicted it to be a suicide.

Case 106.

The deceased was a 29 year old single unemployed male. He died as a result of multiple injuries from being hit by a motor vehicle on the highway. There were reports that he appeared to be deliberately walking into the path of oncoming traffic. The pathology report did not find any substances present in the deceased's system, but there were some concerns about the validity of the drug tests. The deceased was believed to be engaging in self harm due to cigarette burns and cuts on his arms that were consistent with self inflicted injuries. Just prior to his death, the deceased's behaviour was described as disturbed, agitated, and unusual, and that he was likely to be suffering mental health issues. The initial police hypothesis was that the manner of death was an accident. However, following a more thorough investigation and

report, the police stated that the death was suicide. The coroner declared Case 106 to be undetermined, but the C&RT model predicted it to be a suicide.

11.8 Accidental death determinations

11.8.1 Accidental death C&RT - A

The optimal tree structure for accidental death determinations following pruning was tree 5 (refer to Table 14).

Table 14.

Cost complexity measures of the C&RT predicting a coroners' determination of accidental death (all variables).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1	12	0.137615	0.032997	0.036697	0.000000
2	10	0.137615	0.032997	0.045872	0.004587
3	8	0.137615	0.032997	0.064220	0.009174
4	6	0.137615	0.032997	0.091743	0.013761
5*	**3**	**0.146789**	**0.033897**	**0.137615**	**0.015291**
6	1	0.330275	0.045048	0.330275	0.096330

Note: ***bolded text***=optimal tree

As can be seen in Figure 3, the first split was for the presence of a negative mood or stressors prior to death. The second spilt was for police hypothesis of homicide.

The C&RT model correctly identified 86.24 % of cases (refer to Table 15). Fifteen cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The C&RT model predicted five of these cases to be an accident (when the coroner determined that they were a suicide, homicide, or undetermined), and ten cases to be suicide, homicide or undetermined, when the coroner determined that they were an accident death.

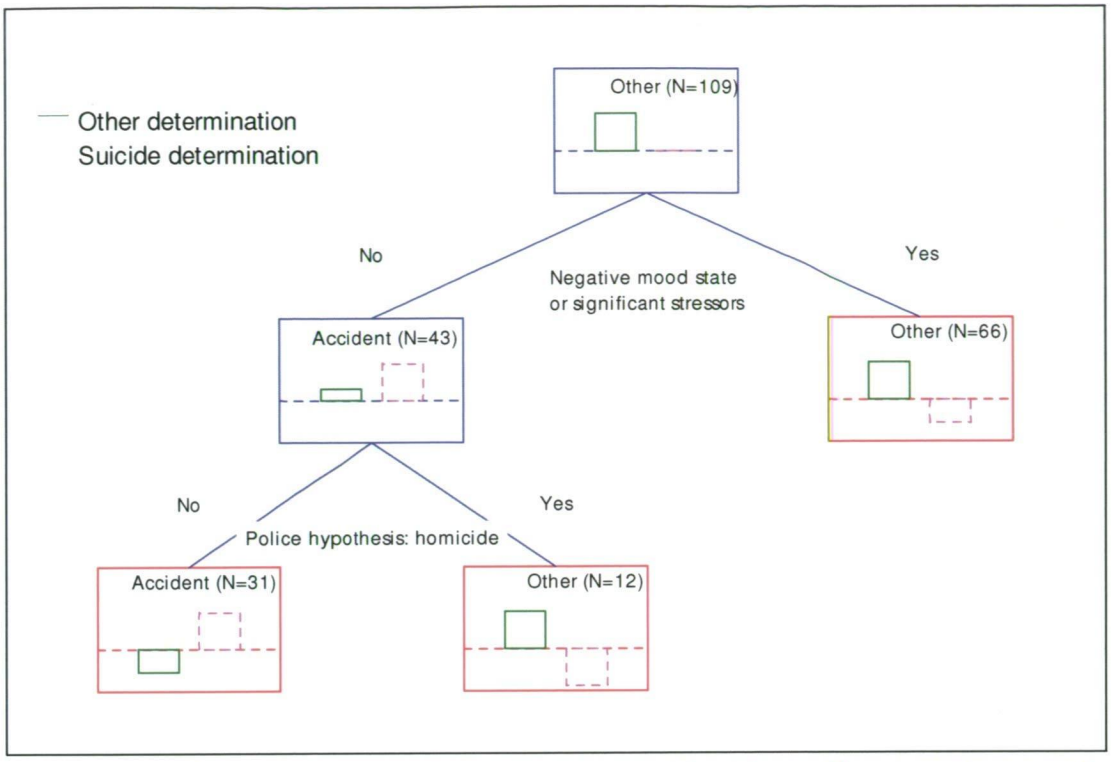

Figure 3. Classification tree for predicted coroner manner of death for accident determinations: all variables.

Table 15.

Classification table for accidental death determinations (all variables) based on the optimal tree.

Predicted	Observed		Total
	Other determination	Accident determination	
Other determination	68	10	78
Accident determination	5	26	29
Total	73	36	109

Specificity: 93.15% (=68/73). Sensitivity: 72.22% (=26/36). Re-substitution cost: 8.26% [=(8+1)/100]. Total accuracy rate: 91.74% [=(79+21)/109].

11.8.2 Accidental death C&RT - B.

The optimal tree structure for accident determinations following pruning was tree 6 (refer to Table 16).

Table 16.

Cost complexity measures of the C&RT predicting a coroners' determination of accidental death (all variables, excluding police hypotheses).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1	18	0.311927	0.044374	0.045872	0.000000
2	14	0.311927	0.044374	0.064220	0.004587
3	8	0.302752	0.044007	0.119266	0.009174
4	5	0.275229	0.042779	0.155963	0.012232
5	4	0.293578	0.043619	0.183486	0.027523
6*	**2**	**0.275229**	**0.042779**	**0.247706**	**0.032110**
7	1	0.330275	0.045048	0.330275	0.082569

Note: ***bolded text**=optimal tree

As can be seen in Figure 4, the first and only split was for the presence of a negative mood or stressors prior to death.

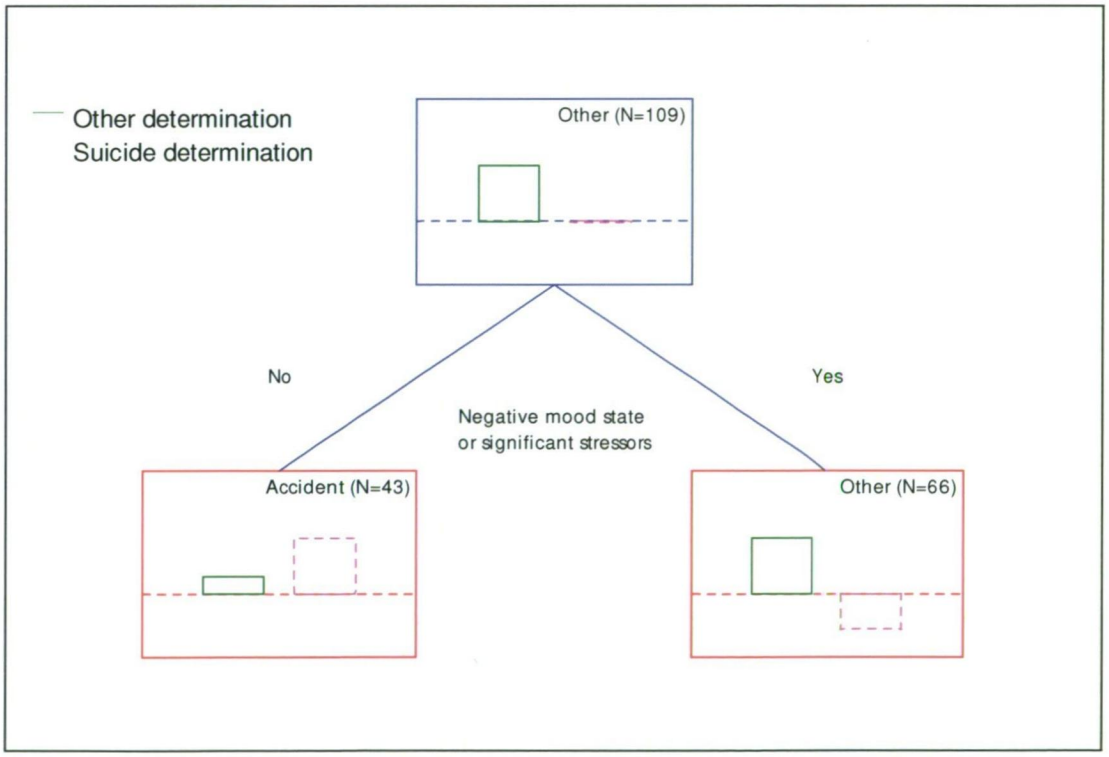

Figure 4. Classification tree for predicted coroner manner of death for accident determinations: all variables, excluding police hypotheses.

The C&RT model correctly identified 75.23 % of cases. Refer to Table 17. Twenty seven cases were identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The C&RT model predicted 17 of these cases to be an accident (when the coroner determined that they were a suicide, homicide, or undetermined), and 10 cases to be suicide, homicide or undetermined, when the coroner determined that they were an accident.

Please note that a classification table for predicted determinations (based on the accidental death C&RT – B) against observed police hypothesis for accidental death cases can be found in the Appendix.

Table 17.

Classification table for accidental death determinations (all variables, excluding police hypotheses) based on the optimal tree.

Predicted	Observed		Total
	Other determination	Accident determination	
Other determination	56	10	66
Accident determination	17	26	43
Total	73	36	109

Specificity: 76.71% (=56/73) Sensitivity: 72.22% (=26/36) Re-substitution cost: 24.77% (=(17+10)/109). Total accuracy rate: 75.23% (=(56+26)/109)

10.8.3 Discrepant cases

The following cases are those in which the observed outcome did not match what was predicted for accidental death determinations based on C&RT - A (all variables).

Case 5.

The deceased was a 20 year old single female, who worked as a sales assistant. She died as a result of head and chest injuries resulting from a single vehicle crash. The pathology report found alcohol (0.141g/100ml) and low levels of prescription medication in her system. She was being treated for issues related to social anxiety

and depression. She had a previous history of suicide attempts, self harm (cuts on wrist) and had recently made a threat to kill herself. At the time of her death, she was reportedly unhappy due to the breakdown of a relationship with her boyfriend, and a recent miscarriage. The initial police hypothesis was that the manner of death was a suicide. However, following a more thorough investigation and report, the police stated that the death was an accident. The coroner determined Case 5 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 9.

The deceased was a 55 year old married unemployed female. She died in her home as a result of a pulmonary embolism, deep vein thrombosis, plus the sedative effects of medication and alcohol. The pathology report found alcohol (0.186g/100ml) and two types of prescription medication at therapeutic and greater than therapeutic levels. The deceased had a history of depression and adjustment disorder, and was suffering chronic pain and asthma. She had a history of self harm and suicide attempts, including cutting, and at least three attempted overdoses. She was described as often being 'moody' and was experiencing relationship strains at the time of her death. She was reportedly planning to attend a birthday party, and play cards with friends. The police stated that the manner of death was 'unknown'. The coroner determined Case 9 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 14.

The deceased was a 74 year old, widowed female pensioner. She was found dead in her bed, and the cause of death was determined to be from a paracetamol overdose. The pathology report stated that she had fatal levels of paracetamol in her system, and three types of prescription medication at therapeutic and sub-therapeutic levels.

It was not known if she had a history of mental illness or self harm. She suffered extensive medical conditions, including high blood pressure, hip and knee osteoarthritis, chronic renal disease, urinary tract infection, chronic airways disease, and emphysema. The initial police hypothesis was that the death was due to natural causes. The coroner declared Case 14 to be undetermined, but the C&RT model predicted it to be an accidental death.

Case 18.

The deceased was a 24 year old single male. He died at his home (outside) from combined drug intoxication. The pathology report found the presence of alcohol (0.271g/100mL), and three types of prescription medication, including greater than therapeutic levels of Olanzapine. The pathologist also found that the deceased was suffering from ischaemic heart disease at the time of his death. He had a history of schizophrenia and substance abuse, and a previous criminal history. He had a history of making suicide threats, but none reported just prior to his death. At the time of his death, the deceased was agitated and intoxicated, and had recently had an argument with his family. The police stated that the manner of death was 'unknown'. The coroner determined Case 18 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 23.

The deceased was a 31 year old single female, employed at the time of her death. The deceased was found in her bedroom. The pathologist was unable to definitively determine the cause of death, but hypothesised that she died from pulmonary emboli. The pathologist also found the presence of alcohol (0.023g/mL), marijuana, and therapeutic levels of Chlorpheniramine, paracetamol and pseudoephedrine. The deceased did not have a known history of self harm or threats of suicide. She was

recently involved in a motor vehicle accident, for which she sustained a broken collar bone. She was described as being in good spirits just prior to her death. The police stated that the manner of death was 'unknown'. The coroner declared Case 23 to be undetermined, but the C&RT predicted it to be an accidental death.

Case 31.

The deceased was a 43 year old divorced male, who was an unemployed truck driver. The cause of death was determined to be alcoholic liver disease. His body was found in the living room of his home. The pathology report found no alcohol in his system, and only low therapeutic levels of paracetamol. It was also found the deceased suffered from liver disease and cirrhosis. He had a history of depression and over 20 years of alcohol abuse and dependence. It was unknown if he had a history of suicide attempts – it was alleged, but this information was hearsay. The deceased was allegedly depressed just prior to his death, but had also made plans to visit his ex-partner and children interstate. The police hypothesised that the manner of death was either 'unknown' or due to natural causes. The coroner determined Case 31 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 40.

The deceased was a 46 year old male, who was born overseas. At the time of his death, he was a public service employee, and in a de-facto relationship. He was found dead inside his parked car, as a result of carbon monoxide poisoning (from the car exhaust fumes). Aside from carbon monoxide, the pathologist did not find any alcohol or other substances in his system at the time of his death. There was no suicide note present, and he had no formal history of mental illness, self harm or suicide threats. However, he did have a history of abusing alcohol and had reportedly felt some guilt over leaving his children. Although, just before his death, he was

reported as being 'normal and happy' and his behaviour and mood was "nothing out of the ordinary". The deceased had also made plans to pick up his partner from work, and attend a concert with work colleagues. The police stated that the manner of death was 'suicide'. The coroner determined Case 40 to be a suicide, but the C&RT model predicted it to be an accident.

Case 48.

The deceased was a 52 year old divorced male, who was employed at the time of his death (but was on sick leave). The deceased's body was found slumped in his bed. The cause of death was a mixed drug overdose. The pathology report found fatal levels of Propoxphen, and therapeutic to high therapeutic levels of Oxycodone, Morphine, Diazepam and Fluoxetine. The deceased had a history of depression, and was known to be a prescription drug abuser. He also suffered from a number of medical conditions including prostrate cancer, radiation proctitis, pneumonia, seizures and chronic back pain. He did not have a history of suicide attempts or self harm, but had previously taken an overdose of prescription medication in order to "get high and rest". He had future plans of going back to work. The (implied) police hypothesis was that this was an accidental death. The coroner determined Case 48 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 62.

The deceased was a 62 year old married female, who was a retired teacher. Her body was found inside her bedroom, and the cause of death was deemed to be from combined drug intoxication. The pathologist found the presence of alcohol (0.194g/mL), and therapeutic to sub-therapeutic levels of Oxycodone, Amitriptyline, Nortriptyline, Flunitrazepam, Aminoflunitrazepam, Temazepam, and Lignocaine. The deceased had a history of medical problems, but the true extent of this was

unclear (as it was hypothesised that the deceased may have exaggerated her medical symptoms). The deceased claimed to have Multiple Sclerosis and leukaemia (but this was not found during the autopsy). She also had a history of chronic back pain, moderate ischaemic heart disease and syncopal episodes. Her mental state just prior to death was unknown, but she was described as being "down in the previous week", and was using alcohol excessively. The police stated that the manner of death was 'unknown'. The coroner determined Case 62 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 69.

The deceased was a 50 year old divorced pensioner. The deceased was found dead in his kitchen from a drug overdose. The pathologist found the presence of alcohol (0.175g/mL) and fatal levels of morphine, and five other types of medications, ranging from therapeutic to greater than therapeutic levels. At the time of his death, the deceased was suffering from hypertension, Cohn's Disease, chronic pain, osteoporosis, pneumonia, hyperprolactinemia and a gastro-oesophageal reflux disease. He also had a history of depression, but it was unknown if he had a history of self harm or threats of suicide. The police stated that the manner of death was 'unknown'. The coroner determined Case 69 to be undetermined, but the C&RT model predicted it to be an accidental death.

Case 75.

The deceased was a 54 year old single pensioner. The deceased died while on the toilet, and the cause of death was determined to be from mixed drug toxicity. The pathologist found fatal levels of Olanzapine, and therapeutic to below therapeutic levels of three other types of medication. At the time of his death, the deceased was considered obese, and was suffering from chronic obstructive airways disease, fatty

liver disease, and early fibrosis. The deceased had a history of psychosis, depression and anxiety. The deceased was described as "cheerful" just prior to death, but also reportedly unwell and had just experienced the death of a close friend. The police stated that the manner of death was 'unknown'. The coroner determined Case 75 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 81.

The deceased was a 25 year old single female, employed at the time of her death. She was found dead in her bedroom, and the cause of death was determined to be a drug overdose. The pathologist found the presence of a number of prescriptions drugs, including diazepam, nordiazepam, methadone, morphine and fluoxetine, as well as illicit drugs (methylamphetamine). The deceased was witnessed consuming alcohol the night before her death, but the toxicology report did not find the presence of alcohol in her system. The deceased had a history of depression, poly-drug dependency, anorexia and bulimia. She also had a past history of suicidal ideation. She was reportedly the victim of childhood sexual abuse, and at the time of her death she was experiencing relationship problems and work stress. It was reported that the deceased had mentioned plans of taking a trip to the coast with a friend, but was described as depressed and agitated just prior to her death. There was no police report present in the coronial file; therefore the police hypothesis is unknown. The coroner determined Case 81 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 88.

The deceased was a 27 year old single male, who was employed at the time of his death. The deceased was found in his living room, and the cause of death was

determined to be combined drug intoxication. The pathologist found fatal levels of methadone, and therapeutic or sub-therapeutic levels of amitriptyline, diazepam, aminonitrazepam and ibuprofen. The pathologist found that the deceased was suffering from atherosclerosis at the time of his death. The deceased had a history of depression, anxiety, and narcotic addiction. It was unknown if the deceased had a history of self harm but he had recently made a threat to jump off a bridge, and had a history of past suicidal ideation. Just prior to his death, it was reported that the deceased had been upset and crying, and had recently had a fight with his father. The police stated that the manner of death was 'unknown'. The coroner determined Case 88 to be an accidental death, but the C&RT model predicted it to be a suicide, homicide or undetermined death.

Case 91.

The deceased was a 58 year old single male, who was employed as a casual labourer. He died as a result of cardiac trauma from a single motor vehicle crash. There were no swerve marks present at the scene of the crash. The pathologist found therapeutic levels of paracetamol, and sub-therapeutic levels of salicylic acid. The deceased did not have any record of a diagnosed mental illness, but was socially isolated, was described as being "down", and had told significant others that he "didn't have a good Christmas". The deceased had mentioned plans of returning to work. The initial police hypothesis was that the manner of death was either a suicide or accident. However, following a more thorough investigation and report, the police stated that the death was an accident. The coroner determined Case 91 to be an accidental death, but the C&RT model predicted it was not an accident and was therefore a suicide, homicide or undetermined death.

Case 105.

The coroner declared Case 105 to be undetermined, but the C&RT model predicted it to be an accident. See above case description under 'discrepant cases' for suicide determinations.

11.9 Homicide determinations

11.9.1 Homicide C&RT - A.

The optimal tree structure for homicide determinations following pruning was tree 1 (refer to Table 18).

Table 18.

Cost complexity measures of the C&RT predicting a coroners' determination of homicide (all variables).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1*	**2**	**0.018349**	**0.012855**	**0.009174**	**0.000000**
2	1	0.201835	0.038444	0.201835	0.192661

Note: ***bolded text***=optimal tree

As can be seen in Figure 5, the first and only split in the tree was for police hypothesis of homicide. This indicates that a police hypothesis that the death was a homicide was the most powerful variable in predicting a homicide determination by the coroner.

The C&RT model correctly identified 99.08 % of cases (refer to Table 19). One case was identified as being 'discrepant' because the observed outcome did not match the statistically predicted outcome. The C&RT model predicted this case to be a homicide, when the coroner concluded that it was undetermined.

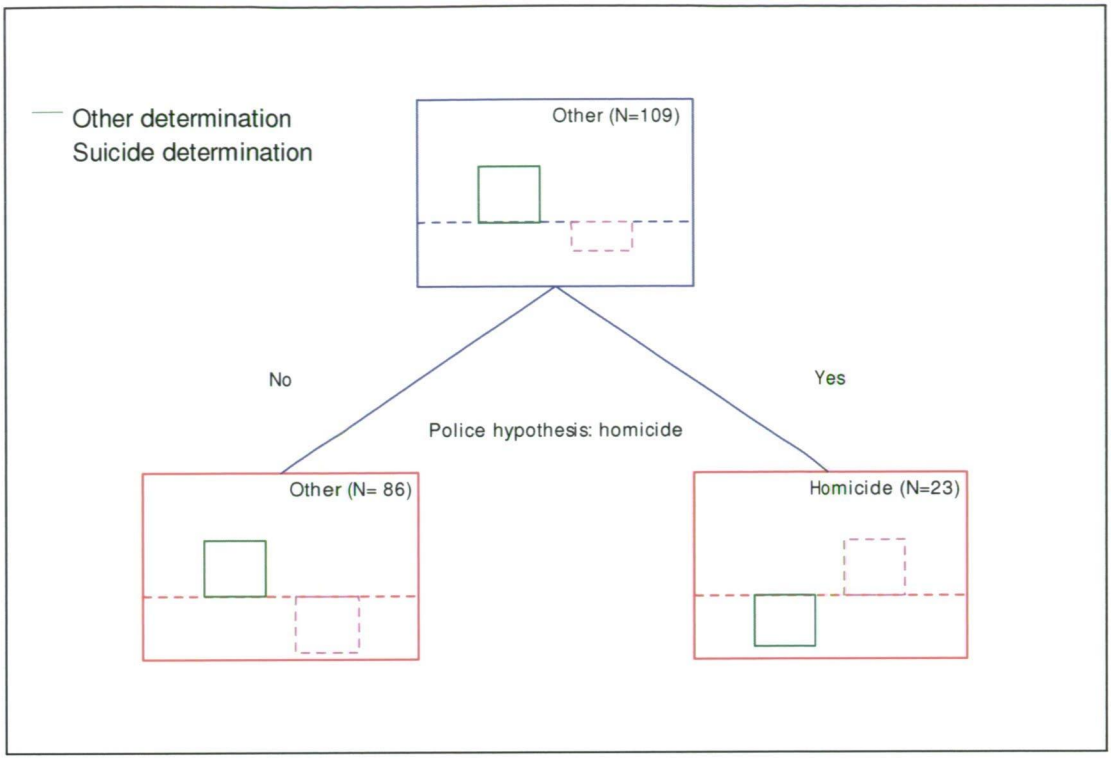

Figure 5. Classification tree for predicted coroner manner of death for homicide determinations: all variables.

Table 19.

Classification table for homicide determinations (all variables) based on the optimal tree.

Predicted	Observed		Total
	Other determination	Homicide determination	
Other determination	86	0	86
Homicide determination	1	22	23
Total	87	22	109

Specificity: 98.85% (=86/87). Sensitivity: 100% (=22/22). Re-substitution cost: 0.09% [=(1+0)/100]. Total accuracy rate: 99.08 *% [=(86+22)/109].*

10.9.2 Homicide C&RT - B.

The optimal tree structure for homicide determinations following pruning was tree 5 (refer to Table 20). There were no splits produced. Therefore the C&RT model did

not identify any variables that could significantly predict a homicide determination by the coroner.

Table 20.

Cost complexity measures of the C&RT predicting a coroners' determination of homicide (all variables, excluding police hypotheses).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1	11	0.247706	0.041347	0.045872	0.000000
2	9	0.247706	0.041347	0.055046	0.004587
3	7	0.256881	0.041849	0.073394	0.009174
4	5	0.247706	0.041347	0.110092	0.018349
5*	**1**	**0.201835**	**0.038444**	**0.201835**	**0.022936**

Note: ***bolded text***=optimal tree

11.9.3 Discrepant cases

The following cases are those in which the observed outcome did not match what was predicted for homicide determinations based on C&RT - A (all variables).

Case 73.

The deceased was a 74 year old married female who was born in Kenya, but grew up in the United Kingdom. She was on a pension at the time of her death. She died while being nursed in a hospital, but the final cause of death was undetermined. There were suspicions that the deceased may have died from an 'assisted suicide' due to the deceased's close relationship with person(s) found guilty of assisting an elderly man to commit suicide via plastic bag asphyxia and combined drug intoxication. As a result, the case was re-opened for a coronial enquiry and retrospectively investigated. The deceased had been prescribed a range of medications at the time of her death, and the pathologist found high levels of morphine in her system. The deceased also had extensive medical problems, including kidney, heart and lung disease, and emphysema. She also had a previous history of suicide attempts (overdose) and had made recent threats of suicide. At the

time of her death, the deceased was described as depressed, confused, and did not want to be placed in a nursing home. The police stated that the manner of death was homicide. The coroner determined Case 73 to be an undetermined death, but the C&RT model predicted it to be a homicide.

11.10 Undetermined manner of death determinations

11.10.1 Undetermined C&RT - A.

The optimal tree structure for undetermined manner of death determinations following pruning was tree 5 (refer to Table 22). There were no splits produced. Therefore the C&RT model could not identify any variables that could significantly predict an undermined manner of death determination by the coroner.

Table 22.

Cost complexity measures of the C&RT predicting a coroners' determination of undetermined (all variables).

Tree number	Number of terminal nodes	CV cost	CV std. error	Resubstitution cost	Node complexity
1	17	0.238532	0.040821	0.064220	0.000000
2	13	0.238532	0.040821	0.073394	0.002294
3	11	0.238532	0.040821	0.082569	0.004587
4	5	0.247706	0.041347	0.137615	0.009174
5*	**1**	**0.201835**	**0.038444**	**0.201835**	**0.016055**

Note: ***bolded text***=optimal tree

11.11 Summary of predictor variables of manner of death determinations

Both the logistic regression and C&RT models identified asphyxia related deaths as being significant predictors of suicide determinations. In regards to the other cause of death types, the logistic regression model also identified substance related death as a significant predictor variable for accidental death determinations; and stabbing or gunshot related deaths as a significant predictor of homicide determinations. However, the C&RT model did not replicate this finding. Because the C&RT results

supersede the logistic regression results, only asphyxia related death is considered to be a significant predictor of manner of death determination.

The C&RT model also identified presence of a suicide note be a significant predictor variable in suicide determinations. This could not be supported by the logistic regression model, because of its removal from the model due to an inflated standard error score. Again, the C&RT result (in regards to the significance of the suicide note as a predictor variable) ultimately supersedes the logistic regression result.

According to the logistic regression model, the absence of a history of mental illness significantly predicted homicide determinations, but the C&RT model did not support this. Furthermore, the logistic regression and C&RT analyses did not find a history of mental illness to be a predictor in the determination of suicide. However, the presence of a negative mood state (e.g., if the deceased was described as agitated or depressed just prior to their death) or stressors (e.g., loss of employment, relationship breakdown etc.) was a significant predictor for suicide determinations according to both the logistic regression model, and the C&RT model. Both models also found that the absence of a negative mood state or stressors significantly predicted accidental death determinations. Finally, the logistic regression model suggested that the presence of a negative mood state or stressors prior to death significantly predicted undetermined manner of death outcomes, but the C&RT did not support this. However, as previously stated, conclusions will only be drawn from the C&RT in this instance.

The C&RT model found that a police hypothesis of suicide significantly predicted a coronial determination of suicide. Similarly, the presence of a police hypothesis of homicide significantly predicted a coronial determination of homicide, while its absence predicted a coronial determination of accidental death (in

accordance to their respective C&RT models). The logistic regression model also found that the presence of a police hypothesis of accidental death, significantly predicted a coronial determination of accidental death. The presence of a police hypothesis of undetermined manner of death also predicted a coronial determination of accidental death according to the logistic regression model. It should be noted that a number of the police hypothesis variables had to be removed from the logistic regression analysis, because of their tendency to be a 'perfect predictor'. In accordance with the previous results, conclusions will only be drawn from the significant C&RT results regarding police hypotheses.

Both the logistic regression and C&RT models did not find age to be a significant predictor for suicide determinations. The only other variable that was found to be a significant predictor of a manner of death determination was the presence of a medical condition, which (according to the logistic regression model), was a significant predictor of undetermined manner of death determinations. However the C&RT model did not support this result.

11.12 Summary of statistically predicted outcomes vs observed outcomes

Almost all of the logistic regression and C&RT models yielded misclassified (i.e., discrepant) cases between the statistically predicted and observed (coroner determined) manner of death outcomes. Based on the statistical limitations for the logistic regression analysis and inability to enter all of the variables into the analysis, the identification of discrepant cases was based on the C&RT analysis only. The optimal C&RT model for suicide (with police hypothesis of suicide as the only predictor variable) correctly identified 93.58% of observed cases. There were seven 'discrepant' cases that were predicted to be a suicide based on this model. When the police hypothesis variables were removed (leaving presence of a suicide note, asphyxia related deaths, and presence of a negative mood state or stressors as the

significant variables), the C&RT model only correctly classified 91.74 % of observed cases.

The optimal C&RT for accidental death (with absence of a police hypothesis of homicide, and absence of negative mood state or stressors as the significant predictor variables) correctly identified 86.24 % of observed cases. Fifteen cases were identified as discrepant, five of which were predicted to be an accidental death (whereas the observed coronial manner of death determinations were suicide, homicide, or undetermined), and ten cases were predicted to be a suicide, homicide or undetermined, which the coroner had determined to be an accidental death. When the police hypothesis variables were removed (leaving the absence of negative mood state or stressors as the only predictor variable) the model only correctly identified 75.23 % of cases.

The optimal C&RT for homicide (with police hypothesis of homicide as the only significant variable) correctly identified 99.08 % of cases. There was one 'discrepant' case predicted to be a homicide based on this model. When the police hypothesis variables were removed, no other significant predictor variables were included in the model. Similarly, the C&RT tree model for undetermined manner of death cases identified no predictor variables; therefore no discrepant cases could be identified.

Chapter 12. General Discussion and Conclusion

12.1 General Discussion

The aim of the current study was to identify the main predictor variables in coronial manner of death determinations, and then use these predictor variables to develop a statistical model to see whether predicted outcomes match observed outcomes, and if not, which cases were considered 'discrepant'. This model was intended to provide insight into the decision making processes of the coroner, and which variables were considered the most important when making manner of death determinations.

It was hypothesised that an active cause of death (i.e., asphyxia related deaths) would predict suicide determinations, while a passive cause of death (i.e., substance related deaths) would predict determinations of accidental death and an undetermined manner of death. This was partially supported, with only asphyxia cause of death (i.e., hanging, drowning, and choking) found to significantly predict suicide determinations. It was also hypothesised that the presence of a suicide note would significantly predict suicide determinations, which was supported by the current results. Against what was predicted, age of the deceased and a formal history of a mental illness were not found to be significant predictors. It was also expected that each of the police hypothesis variables would significantly predict their respective manner of death determinations (i.e., the police hypothesis would match the coroner's final manner of death determination). This was partially supported, with a police hypothesis of suicide significantly predicting a coronial determination of suicide, a police hypothesis of homicide significantly predicting a coronial determination of homicide.

Finally, it was hypothesised that for all manner of death determinations (except homicide), there would be a less than 100% match between coroners' statistically predicted determinations in cases of equivocal death, and the observed

determinations. This was partially supported, with the C&RT models for suicide and accident identifying discrepancies between the statistically predicted and observed determinations. However, against what was expected, there were also discrepancies between statistically predicted and observed determinations according the C&RT model for homicide. Furthermore, no discrepant cases could be identified for undetermined manner of death determinations because the C&RT model of undetermined manner of death did not identify any significant predictors.

The current results are consistent with the previous literature that has found that an active cause of death is predictive of suicide determinations (Walsh et al., 1975; Parai et al., 2006; Platt et al., 1988; Salib, 1996; Salib 1997; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002; Linsley et al., 2001). As expected, asphyxia related deaths were shown to have a strong predictive value in the likelihood of a death being determined as suicide. Research has indicated that hanging deaths are nearly always classified as a suicide (Cooke et al., 1995; Bennewith et al., 2005; Sauvageau, 2009). In a six-year review by Sauvageau (2009), suicide was found to be the leading manner of death in all studies on asphyxia by hanging in the forensic literature, with figures ranging from 93.2% to 100%. This may be due to the fact that hanging type deaths are often seen as demonstrating a deliberate 'intent to die' by the deceased due to the preparation required to carry out the act, and a higher likelihood of lethality than other methods.

However, it should be noted that for the current statistical analysis, drowning and choking deaths were collated under the umbrella term of 'asphyxia related' deaths. The literature suggests that drowning deaths are more often associated with accidental and undetermined manner of death outcomes (Salib & Agnew, 2005) due to the ambiguity around the intent of the deceased. Therefore with a greater number of cases, it would be ideal to separate out each of these causes of death, to more

clearly distinguish if hanging deaths were the predominant predictor of suicide determinations.

The literature has also consistently found a passive cause of death to be predictive of accidental and undetermined manner of death outcomes (Stanistreet et al., 2001; Walsh et al., 1975; Salib, 1996; Linsley et al., 2001). This could not be supported by the current results, with only the logistic regression model finding substance related deaths to be a significant predictor of accidental death determinations. Unlike more 'active' causes of death, substance overdose does not necessarily imply the same degree of deliberateness (Robertson & Crawley, 2009). Therefore it is more difficult for the coroner to establish clear intent by the deceased in these cases. Unfortunately, the C&RT model could not replicate this result, so the true influence of substance overdose in predicting manner of death determinations warrants further investigation.

The finding that suicide note is a significant predictor of suicide determinations is not surprising given that many coroners or medical examiners are only willing to reach a determination of suicide if a suicide note is present (Litman et al., 1963; Farberow et al.,1977). This result is also consistent with other studies that have utilised a similar statistical analysis to predict manner of death outcome. Linsley et al. (2001) found that the presence of a suicide note was the strongest predictor in correctly differentiating between suicide determinations and undetermined findings. Furthermore, a suicide note is often seen as an intimation of suicidal intent, which is frequently cited as a key predictor in suicide determinations (Walsh et al., 1975; Salib, 1996; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002). Some studies have also found that when fictional scenarios featured the presence of a suicide note, the decision maker had greater odds of a reaching the 'correct' manner of death determination (Parai et al., 2006). However, suicide notes

are only left in a minority of suicide cases, with figures ranging between four percent (O'Donnell et al., 1993) and 43% (Salib et al., 2002). This is consistent with the results of the current study, whereby a suicide note was present in only 37.93% of cases where manner of death was determined by the coroner to be suicide. Therefore, it is important to note that even if a suicide note is absent, it does not immediately rule out the possibility that the manner of death was a suicide.

Against what was hypothesised, age of the deceased was not found to be a significant predictor using either the logistic regression or classification tree models. However, one must remember that there were only three cases in the entire sample whereby the deceased was under the age of 15 years. The age distribution of the sample was limited by the jurisdiction from which the sample was selected. While the evidence suggests that deaths of adolescents and young adults are often equivocal in nature (and therefore may be expected to constitute a considerable proportion of the total number of cases) this was not found to be the case with the present sample, with the mean age of the deceased for each manner of death determinations types ranging between 43 and 49 years of age.

Despite age being a non-significant predictor, it is interesting to note that one of the suicide cases that was deemed 'discrepant' by the classification tree model was that of a 13 year old boy who hung himself from a bunk bed (case 4). While accidental cases of asphyxia among children do occur, they are usually seen as being uncommon (Clark et al. 1993). Furthermore, in this particular case the deceased had actually made a threat that he would kill himself just prior to his death. This intimation of intent, combined with the method used (which the current results found to be a significant predictor of suicide), and a police hypothesis of suicide, perhaps suggests that other factors outside of the case evidence may have influenced the coroner's final decision.

The outcome of case four is not entirely unexpected given that a large body of research suggests that childhood suicides are often misclassified as accidental deaths (Paulson et al., 1978; Robertson & Crawley, 2009), despite evidence to suggest that children as young as five are capable of understanding the concept of suicide. A reluctance by the coroner to classify a childhood death as a suicide could be due to a number of different reasons, including the general stigma attached to suicide and potential negative perceptions towards the family of the deceased child (Rudestam & Imbrol, 1983; Calhoun et al., 1980), misconceptions about children's understanding of death (Greene, 1994; Mishara 1999; Crepeau-Hobson, 2010); and general lack of training around childhood suicide (Nelson & Crawford, 1990). However, the current study did not directly investigate these issues, and further research needs to be conducted using a larger sample of child deaths.

The presence of a negative mood state or significant stressors prior to death was also a predictor of suicide determinations (when present) and accidental death determinations (when absent). Previous literature has not specifically examined the role of this variable in predicting coronial manner of death determinations. However, Salib (1996; 1997) found that the presence of an informal psychiatric history is a predictor of suicide determinations. This shares similarities with the negative mood state variable, in that both are based on informal observations about the mental state of the deceased from family members and friends.

Furthermore, while a history of recent stressful life events (such as the breakdown of a relationship, recent unemployment, death of a loved one, etc.) has not been specifically investigated in regards to predicting manner of death determinations, there is some evidence to suggest that it is an important consideration in coronial decision making. Carpenter et al. (2009) investigated death investigations in the Australian state of Queensland (following the implementation of the new

Queensland Coroners Act 2003, which gave coroners the responsibility to determine the level of invasiveness of autopsies), and found that the 'existence of triggers' was the leading non-autopsy factor (75.66% of cases) in the coroner not requiring a full internal autopsy in order to reach a suicide determination.

The presence of recent stressors is also frequently cited as a significant risk factor in the completion of suicide (Moscicki, 1995; Vassilas & Morgan, 1997; Joiner, Walker, Rudd & Jobes, 1999). For example, Cheng, Chen, Chen, and Jenkins (2000) conducted a psychological autopsy on 113 cases of suicide in Taiwan and compared them to 226 living controls. It was found that a significantly higher proportion of suicide cases had experienced some kind of 'loss' in the year before the suicide, compared to the control subjects. Similar results have been found in regards to the suicide deaths of both adolescents (Brent, Perper, Mortiz, & Allman, 1993; Marttunen, Aro & Lonnqvist, 1993), and older adults (Conwell, Duberstein, & Caine, 2002; Beautrais, 2002; Rubenowitz, Waern, Wilhelmson & Allebeck, 2001). Thus, this may be an important piece of evidence that the coroner considers when determining manner of death.

While some of the previous literature identified a formal history of psychiatric contact to be a significant predictor in suicide determinations (Stanistreet et al., 2001) and an undetermined manner of death (Salib, 1996; 1997), the current results did not support this. The current findings are more consistent with that of Platt et al. (1988) and Linsley et al. (2001), who found that manner of death determinations could not be distinguished by previous psychiatric contact. Robertson and Crawley (2009) had a similar outcome in their study of a single British coroner, stating that "psychiatric history was a variable of little importance to this coroner's decisions, as it was a factor in the majority of reviewed cases" (p. 233). A number of other studies have also suggested that high rates of mental

disorders occur amongst both suicide and accidental deaths (Rorsman, Hangell & Lanke, 1982; Harris & Barraclough, 1997; Ruschena et al, 1998; Hiroeh, Appelby, Mortensen & Dunn, 2001) and undetermined deaths (Holding & Barraclough, 1978). This is in accordance with the current results, whereby a history of mental illness could not distinguish between the different manner of death determinations due to its tendency to be present across a wide range of cases reviewed by the coroner. Thus, the current finding may be because presence of a 'history of mental illness' did not discriminate between specific types of mental illness. Tanney (1992) asserts that suicide occurs more frequently in the presence of affective disorders, including major depression and bipolar disorder, than with any other mental disorders. Some studies have investigated the differences between specific types of mental illness and manner of death determinations. For example, two case-controlled psychological autopsy studies (Cheng, 1995; Gau & Cheng, 2004) utilising the same Taiwanese population, examined suicide deaths and accidental deaths and found that rates of alcohol related disorders were similar in cases of suicide (44%) and accidental death (54%). However, the rates for major depression were higher in suicide (87%) than in accidental death (30%). On the other hand, adjustment disorders (18%) and anxiety disorders (12%) were more prevalent in cases of accidental death than in suicide.

These results are also consistent with an earlier study done by Holding and Barraclough (1978) who found that while depression was frequently diagnosed amongst suicide, accidental death and undetermined manners of death determinations; it was present in significantly more suicide than undetermined cases, and significantly more undetermined than accidental death cases. However, other studies have found that the presence of depression could not differentiate between suicide and undetermined manner of death determinations (Jacobson, Bagley & Rehin, 1976). Therefore, future research is needed to explore whether specific types

of mental illness that are linked to a higher risk of completed suicide, also have greater predictive value of suicide determinations by coroners.

The police hypotheses variable was a consistently strong predictor across a number of manner of death determinations. This could be expected given that the police largely consider the same case evidence as the coroner, such as death scene information, mental heath history, and testimonies from friends or relatives. Furthermore, police in most states across Australia are required to record evidence in a standardised national police form, which has helped to improve the consistency of data collection across the jurisdictions that have implemented this practice (De Leo et al., 2010; ABS, 2009). However for suicide cases, there was an interesting discrepancy between what the police hypothesised versus what the coroner ultimately determined. This may be due to coroners remaining more cautious than the investigating police when it comes to commenting on intent, due to the wide reaching consequences of their decisions. As a result, coroners may be placed under additional pressures depending on the victim's age, social standing, families' and communities' distress and emotional wellbeing, cultural and religious interests, and possible financial impacts such as insurance claims (De Leo et al., 2010). Thus, coroners may be inclined to make less stigmatising and more sympathetic determinations than the police (Barraclough & Harris, 2002).

While the pathologist hypothesis variable was not found to be a significant predictor (which may have been due to the high proportion of instances whereby the pathologist did not explicitly express an opinion about the intent of the deceased), it is interesting to note that a number of the cases identified as 'discrepant' by the suicide C&RT model, were cases whereby the pathologist suggested the death was 'self inflicted'. These included cases 87 and 97, both of which were left undetermined by the coroner, but were predicted to be suicides by the statistical

model. While the study by Barraclough et al. (1976) found no significant deviations between a sample of coroners and pathologists when reaching determinations for 330 cases of unnatural deaths from the Inner West London Coroner's district, there has been little to no research comparing coroners and pathologists' decision making processes. As in the case of the police, pathologists would be placed under fewer social, cultural and familial pressures than the coroner. Thus, pathologists may be less conservative than coroners when it comes to commenting on the intent of the deceased. Furthermore, pathologists are likely to use a different standard of proof to the coroner. For example, it has been found that suicide mortality rates tend to be higher when the determinations of suicide are based on clinical, rather than a legal criterion (e.g., O'Donnell & Farmer, 1995; McCarthy & Walsh, 1975; Gosney & Hawton, 2007).

It should also be noted that a number of other variables were found to be significant by the logistic regression model, but these results were not replicated by the C&RT model (e.g., the presence of a medical condition in predicting an undetermined manner of death, and the presence of gunshot or stabbing cause of death in predicting homicide determinations). This result may suggest that these variables do play a role in predicting manner of death determination, but were not found to be significant by the C&RT models due to a relatively small sample size. Similarly, the variables that were removed from the logistic regression analysis due to being 'perfect predictors' (that were not found to be significant by the C&RT model), are also important to acknowledge. For example, there were no cases with an undetermined manner of death where cause of death was due to asphyxia, gunshot or stabbing, and there were no cases with a homicide determination, where the cause of death was substance related. Similarly, there were no cases with an accidental death determination in which the pathologist had hypothesised that the death was self

inflicted. A variable being 100% present (or absent) within itself may be an indication of its strength as a predictor for their respective manner of death determinations. These variables may not have been found to be significant by the C&RT model due to small numbers. Therefore future research may want to re-examine whether these variables are indeed significant predictors of coronial manner of death determinations with a larger sample size or a more sensitive statistical analysis.

Finally, it was expected that there would be less than a 100% match between the observed and statistically predicted outcomes for each of the manner of death determination types, except in regards to homicide cases. Consistent with the hypothesis, there were overall discrepancies between the observed manner of death determinations made by coroners and what was statistically predicted. This is supported by the results of a large body of research that suggests that decision makers frequently misclassify deaths, especially suicide (e.g., Huusko & Hirvonen, 1988; Ohberg & Lonqvist, 1998; Donaldson, et al., 2006). This finding also reinforces studies that have utilised clinical scenarios and have found great variability in manner of death determinations (Jarvis et al., 1991; Goodin & Hanzlick, 1997; Hanzlick & Goodin, 1995; Roberts et al., 2000; Parai et al. 2006). In Robertson and Crawley's (2009) study examining the consistency of decisions made by a single British Coroner, it was found that seven cases of the 29 cases reviewed, did not match what was statistically predicted. Specifically, four of the cases that were observed to be an accidental death or undetermined manner of death were classified as suicides by the multidimensional scalogram analysis (MSA). Similar results were obtained in the current study, whereby the optimal classification tree model predicted seven cases to be suicides, when the coroner determined they were accidental deaths or left them undetermined. Such inconsistencies may impact

on the accuracy of mortality data, as well as having important implications for the broader understanding of suicide risk factors, identifying at-risk populations, the development and provision of effective clinical care, and implementing suicide prevention programs.

A large number of the discrepant cases involved causes of death which are often considered to be among the most 'equivocal'. These included substance related deaths (cases 9, 14, 18, 48, 62, 69, 75, 81, 88, 96, and 97), single vehicle deaths (cases 5 and 91), and a self-induced asphyxia by an adolescent, which could bear resemblance to "the choking game" (case 4). As noted in the literature, equivocal cases such as these pose challenges to the coroner due to the difficulty identifying the circumstances surrounding the death (Jobes, et al., 1986; Jobes et al., 1987; Scott et al., 2006; Knoll, 2008). In the absence of collateral information that clearly shows the intent of the deceased, a coroner may be differ in their approach these types of death, leading to inconsistencies between decision makers.

Against what was predicted, the statistical models also identified discrepant cases for homicide determinations. According to the classification tree model for homicide determinations, there was one 'discrepant' case (case 73). In this instance, the case was re-opened after the police suspected that it was an 'assisted suicide' (i.e., homicide) based on evidence gathered from a related death, and the deceased's history of suicide attempts, suicide threats, and alleged unhappiness at the time of her death. However, due to the lapse in time and inability to conclusively determine the cause of death, the coroner made a decision that the case was undetermined. This may provide further evidence that the coroner's standard of proof is higher than that of the police, and that coroners require clear hard evidence around the intent of the deceased before reaching a decision. It also further highlights that cause of death is an important factor in reaching a manner of death determination (Walsh et al., 1975;

Parai et al., 2006; Platt et al., 1988; Salib, 1996; Salib 1997; Stanistreet et al., 2001; Lindqvist & Gustafsson, 2002; Linsley et al., 2001). In the current study, 75% of cases whereby the cause of death was undetermined, the final manner of death outcome was also undetermined. Again, this may demonstrate the weight the coroner places on cause of death and autopsy findings, and a general reluctance to reach a manner of death determination if the cause of death remains unknown.

It should also be noted that the C&RT tree model for undetermined manner of death determinations identified no predictor variables; therefore no discrepant cases could be identified for undetermined manner of death. This could be expected given that by their very nature, undetermined manner of death cases are those in which the circumstances do not clearly lend themselves to any of the other manner of death determinations. Furthermore, ten of the undetermined manner of death cases were identified as 'discrepant' in the other C&RT models, due to those models predicting them to be a suicide, accidental death or homicide. This would suggest that despite the C&RT undetermined model being unable to highlight any discrepant cases, a large proportion of the undetermined manner of death determinations are likely to be misclassified.

12.2 Implications: towards a more standardised process of decision-making.

Aside from the undetermined cases, the majority of the coronial determinations examined in the current study were consistent with the outcomes predicted by the logistic regression and classification tree models. However, the mere presence of discrepant cases signals the need for greater consistency in coronial decision-making. Robertson and Crawley (2010) suggested that the discrepancies identified in their study might not have arisen if a set of standardised guidelines were available for coroners to rely on, ensuring systematic decision-making processes when ascertaining manner of death in equivocal cases.

In developing a tool to assist coroners to make more accurate and consistent decisions, two potential avenues could be taken. Firstly, coroner's determinations of manner of death may benefit from a greater clinical focus in their decision making, especially in regards to determinations of suicide. As noted, coroners within an Australian jurisdiction are generally from a legal background (i.e., a magistrate), and the standard of proof they require to reach a determination of suicide is high (Freckelton & Ranson, 2006). As such, they may not have the training or experience in identifying risk factors pertinent to suicide, and an inability to reach such a decision without hard evidence of intent (e.g., a suicide note).

Recently, there has been a large body of research that has explored the usefulness of psychological autopsies as a tool to assist medical examiners and coroners to make manner of death determinations in cases of equivocal death. The psychological autopsy involves the reconstruction of the decedent's behaviour and communication in their final days, in addition to their history, personal habits, personal traits and character (Jobes, Berman & Josselson, 1986). In essence, it is a retrospective investigation of the intention of the decedent by interviewing key persons who knew them, and through an analysis of collateral records (Shneidman, 1981; Scott et al., 2006). This can provide invaluable and critical information to the decision making processes of a coroner.

Jobes et al. (1986) evaluated the impact of psychological information on medical examiners' determinations of the manner of death in typical and equivocal cases of five case types (single vehicle crash, child death, auto-erotic asphyxia, psychosis related, and a Russian roulette death). It was found that the presence of psychological information had a significant influence on participants' manner of death determinations (and certainty of their decisions) in equivocal cases, and even in some non-equivocal cases. For example, in the equivocal single vehicle crash

scenario, control subjects who certified the case were evenly divided in their determinations of accident, suicide and undetermined. However, when psychological information was introduced that the decedent had a history of depressed affect, anxiety attacks, and recent losses, significantly more participants in the experimental group determined that the manner of death was a suicide.

Other investigators have highlighted the usefulness of psychological autopsies in the certification of auto erotic deaths (Hiss, Rosenberg & Adelson, 1985), in identifying risk factors contributing to completed suicide in children and adolescents (Marttunen, Hillevi & Lonnqvist, 1993), and in the investigation of deaths in prison (Spellman & Heyne, 1989). Data from psychological autopsies could help both clinicians and investigators to identify suicide trends and high-risk groups (Young, 1992). This could potentially help to identify psychological and behavioural antecedents of suicidal behaviour, which can lead to the development of better techniques of prevention and intervention that could ultimately save lives (Jobes et al., 1986). Furthermore, psychological autopsies are thought to be of therapeutic value to survivors, with the potential to provide families with access to the "truth" and a better understanding of the death of their loved one so that they may more appropriately express and overcome their grief (Ebert, 1987; Jobes et al. 1986). Moreover, the psychological autopsy could also have applications in insurance and malpractice claims, criminal cases, estate issues and contested wills, and workers compensation cases (Knoll, 2008).

On the other hand, critics of the psychological autopsy state that there are a number of limitations associated with the psychological autopsy. These include a lack of a standardized protocol, methodological problems, disagreement around suicidology definitions, poor reliability of assessment instruments, lack of homogeneity among studies, and the potential for bias among collateral informants

(Knoll, 2009). Some efforts have been made to produce a standardised procedure for the psychological autopsy. For example, Werlang and Botega (2003) developed a semi-structured interview for the psychological autopsy (which demonstrated high inter-rater reliability). More recently, Snider, Hane and Berman (2006) have proposed a standardized protocol based on information gathered through a survey of experts in the fields of suicide and forensics. Snider et al. argue that having a more standardised procedure for the psychological autopsy will better meet the Daubert Standard of admissibility (i.e., for evidence to be admissible in court, the methods and procedures used must have scientific validity), and can aid in testing the potential error rate of such methods.

However, even if evidence is evaluated by the coroner utilising a greater degree of clinical judgement, this does not always guarantee consistent decisions due to the natural susceptibility of humans to produce errors and biases. This includes the role of biases and heuristics, such as representativeness (which leads to the belief in the law of small numbers) or availability (leading to over-weighing vivid data), as well as ignoring base rates, failing to take into account regression towards the mean, and failure to properly assess co-variation (Grove, Zald, Lebow, Snitz & Nelson, 2000).

As a result, others have argued that mechanical prediction (i.e., using statistical procedures) is the superior method in the process of decision making. Once developed, statistical prediction requires no expert judgment, and can be 100% reproducible (Grove et al., 2000). In one of the earliest reviews of the topic, Meehl (1954) argued that the literature strongly favoured statistical prediction over clinical judgment. Since this pioneer article, a number of other review articles in medical and psychological fields have made similar conclusions, finding that statistical prediction performs as well, if not better than clinical judgement (Sawyer, 1966; Dawes, Faust

& Meehl, 1989; Garb, 1994; Holt, 1970; Marchese, 1992; Sines, 1971; Wiggins, 1981). A meta-analysis by Grove et al. (2000) found that on average, mechanical prediction techniques were approximately 10% more accurate than clinical predictions. Furthermore, depending on the type of analysis used, mechanical predictive methods outperformed clinical predictions in 33% - 47% of the studies reviewed. While the accuracy of clinical predictions was often the same as mechanical predictions, in only 6% - 16% of the studies were they substantially more accurate. Clinical predictions performed less well when predictors included clinical interview data. The superiority of mechanical prediction methods was consistent, and applied across different judgment tasks, type of judges, judges' amounts of experience, or the types of data being combined (Grove et al., 2000).

Some researchers have attempted to take this more standardised approach to decision making by proposing guidelines for coroners and medical examiners to follow, especially around clearer procedures for defining and classifying suicide deaths. For example, the Centres for Disease and Control gathered together a working group representing coroners, medical examiners, statisticians, and public health agencies to develop an operational tool to assist in the determination of suicide (Rosenberg et al., 1988). They established a list of 22 criteria called the Operational Criteria for the Determination of Suicide (OCDS). Rosenberg et al. (1988) argued that the establishment of such criteria would improve the validity and reliability of suicide statistics by: promoting consistent and uniform classifications; making the criteria for decision making in death certification explicit; increasing the amount of information used in decision making; aiding certifiers in exercising their professional judgment; and establishing common standards of practice for the determination of suicide. As a follow-up to the development of the OCDS, Jobes, Casey, Berman and Wright (1991) developed a 16-item instrument called the Empirical Criteria for the

Determination of Suicide (ECDS), made up of some items from the OCDS, and other potential criteria obtained from experts in the field and from the available literature. Concurrent validity for the ECDS was assessed using 126 cases of suicide and accidental death from 70 different medical examiner participants. It was found that the ECDS instrument successfully predicted 100% of the suicides, and 83% of the accidental deaths, thus correctly identifying 92% of all cases (Jobes, Casey, Berman & Wright (1991).

More recently in 2009, the National Committee for Standardised Reporting of Suicide (NCSRS) met to discuss ways to achieve cross-jurisdictional, multiparty agreement on adequate, standard and operationalised criteria and reporting formats for suicide and related data within Australia. Some of the topics discussed included standardising the information data provided to coroners from primary sources (e.g., from the police and psychological autopsies), providing practice aids, using graded determinations of suicide (e.g., "possible", "probable", "beyond reasonable doubt") and providing greater administrative leadership by chief coroners (De Leo et al. 2010).

Some authors argue against the strict use of a decision making criteria when there is insufficient evidence to make a determination (Donoghue & Lifschultz, 1989). This may be important in those cases where there is no information for the intent-related criteria, which may result in an otherwise obvious suicide being classified as "undetermined". Similarly, additional evidence may be present in a case that clearly points to a particular determination, but this information is not easily captured by decision making criteria. For example, the classification tree models in the current study predicted Case 105 (observed to be undetermined by the coroner) to be both a suicide and an accidental death due to the presence of variables which fit the decision making criteria for both types of death. In addition, the classification

tree model predicted Case 40 (observed to be a suicide) to be an accidental death due to a lack of evidence suggesting that the deceased was experiencing a negative mood state or stressors at the time of his death. However, the deceased died from carbon monoxide poisoning in his own vehicle, a cause of death which is highly consistent with suicide (Linsley et al. 2001). Thus, while a more mechanical or standardised process of decision making will result greater reliability, it is still likely to result in a number of misclassified cases. However, it should also be acknowledged that the current statistical model was intended for equivocal cases. Therefore in instances whereby the manner of death is clear and unambiguous (e.g. Case 40 as a suicide), these cases would not necessarily benefit from such a statistical classification.

In addition, standardised guidelines will not be helpful unless the information collected is of a high quality, and this is applied across all phases of the investigation including the primary data gathered by police and pathologists (Lindqvist & Gustafsson, 2002). Furthermore, the process involved in obtaining all of the information necessary to fulfil decision making criteria may be time-consuming and costly, leading to increased workload and paperwork (Donoghue & Lifschultz, 1989). As it stands, coroners often have limited human and other resources and typical handle large caseloads (Studdert & Cordner, 2010). Therefore, it is recognised that any changes to the current system would be a challenging process to undertake.

12.3 Limitations and future research

As noted, one of the main limitations of the current study is that the sample size was not large enough to meet the requirements of some of the statistical procedures performed. While the current study had a larger sample size than Robertson and Crawley (2009; n = 29), it was not as large as other studies that have utilised similar analyses (Stanistreet, 2001; Salib, 1996; 1997). There were a number of problems

encountered with logistic regression models, whereby any variables that perfectly predicted an outcome would produce inflated standard errors, and therefore would not allow a final solution to be reached. As Field (2005) notes, the problem of 'complete separation' often arises when too many variables are fitted to too few cases. This problem was partly addressed through adopting a simpler model (e.g., grouping variables where possible), the removal of variables with inflated standard errors from each model, and conducting additional analysis using classification trees to help confirm the predictive value of the variables identified. However this 'simplification' process came at a cost of not being able to clearly distinguish the roles each factor may have played in predicting manner of death outcomes. For example, the current study combined hanging and drowning deaths under the variable 'asphyxia related deaths' due to low numbers of each.

While coding of the data was as accurate and objective as possible, there were a number of challenges in doing this due the variable and ad hoc manner in which the information was contained within the file. For example, sometimes information was not clearly specified in the file (so was coded as 'not present'), it was unclear if the information was obtained from a reliable source (i.e., hearsay), or the file contained contradictory information (especially around the deceased's mood state at the time of their death). Some files also missed significant pieces of information (e.g., a pathology report, or testimonies from friends or relatives) or it was apparent that information changed throughout the course of the investigation (e.g., the police report). Where possible, information was coded based on the most recent report or statement contained within the file.

Another limitation of the current study was that only one judge was used to code some of the variables (e.g., the presence of absence of negative mood state/significant stressors). Ideally, two judges should have been used to code the

data, with an inter-judge reliability measure used to calculate degree of agreement between the judges. This would have ensured that the coding of variables was as accurate as possible.

Future research in this area would benefit from a larger sample size, ideally in the region of 1000 cases or more. To do this effectively, the process of data collection may need to involve obtaining case information directly from the National Coroner Information System (NCIS). However in doing so, the researcher would be relying on the accurate interpretation and coding of this information in the system, which is usually done by the coroners' clerks (Studdert & Cordner, 2010). Indeed, one of the concerns raised in Australia by the National Committee for the Standardised Reporting of Suicide, is the accurate coding of deaths into the NCIS (De Leo et al., 2010). A larger sample size would also allow a greater number of more specific variables to be included in the analysis. However, one needs to be careful to not to produce a model that is too complex, and therefore not parsimonious.

In addition, the current study was unable to draw conclusions around the role of factors outside the case evidence that may have played a role in the cases reviewed (e.g., social stigma, beliefs around children and suicide, religious and cultural factors etc). Thus, future research may also look at these factors more closely by conducting interviews with the presiding coroners of cases identified as 'discrepant' to identify what (if any) non-evidentiary factors influenced their final decisions in these cases. The themes derived from these interviews could then form the basis of fictional vignettes to determine if the presence or absence of these factors result in significantly different decisions in regards to manner of death determinations.

12.4 Conclusion

While the current study is largely exploratory in nature, the results have provided insight into the coronial decision-making process. The results suggest that factors including cause of death, the presence of a suicide note, the presence of a negative mood state (or stressors) prior to death, and the police hypothesis regarding manner of death are important factors in coroners' manner of death determinations in equivocal cases. The current results also suggest that discrepancies inevitably occur as a result of this decision making process. Despite potential limitations, a more standardised approach is necessary to reduce coroner's susceptibility to making inconsistent decisions. A more consistent decision making process will lead to more accurate mortality data, and a greater understanding of the risk factors involved in different types of deaths. In particular, clinical psychology practice and suicide prevention in general rely heavily on the broader understanding of suicide risk gained from suicide mortality data and related research. The assessment and treatment of those at risk of suicide will ultimately benefit from increased accuracy in suicide statistics (Rudd, 1997). Thus, it is hoped that a more standardised approach to coronial decision making may contribute to the prevention of avoidable deaths.

References

Andrew, T.A., & Fallon, K.K. (2007). Asphyxial games in children and adolescents. *The American Journal of Forensic Medicine and Pathology, 28,* 303-307. doi: 10.1097/PAF.0b013e318148bdb2

Australian Bureau of Statistics (2008). *Mechanism by intent – selected causes.* (ABS Cat. No. 3303.0). Retrieved at http://www.abs.gov.au/ausstats/abs@.nsf/Products/76805A4317CE2A30CA2576F60012502F?opendocument

Australian Bureau of Statistics (2009). *Causes of death, Australia, 2007.* Canberra: ABS (ABS Cat. No. 3303.0). Retrieved at http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3303.02008?OpenDocument

Australian Institute for Suicide Research and Prevention (2003). *International Suicide Rates: Recent Trends and Implications for Australia.* Canberra: Australian Government Department of Health and Ageing. Retrieved at http://www.health.gov.au/internet/main/publishing.nsf/Content/mental-pubs-i-intsui

Ajdacic-Gross, V., Weiss, M.G., Ring, M., Hepp, U., Bopp, M., Gutzwiller, F., & Rössler, W. (2008). Methods of suicide: international suicide. *Bulletin of the World Health Organization, 86,* 726–732. doi:10.2471/BLT.07.043489

Albayrak, A.S. (2009). Classification of Domestic and Foreign Commercial Banks in Turkey, on Financial Efficiency: A Comparison of Decision Tree, Logistic Regression and Discriminant Analysis Models. *The Journal of Faculty of Economics and Administrative Sciences, 14,* 113-139.

Allen, B.G., Calhoun, L.G., Cann, A., & Tedeschi, R.G. (1993). The effects of cause of death on responses to the bereaved: Suicide compared to accidental and natural causes. *Omega: The Journal of Death and Dying, 28,* 39-48.

Ask, K., & Granhag, P.A. (2005). Motivational sources of confirmation bias in criminal investigations the need for cognitive closure. *Journal of Investigative Psychology and Offender Profiling, 2,* 43-63. doi:10.1002/jip.19

Atkinson, M.W., Kessel, N., & Dalgaard, J.B. (1975). The comparability of suicide rates. *British Journal of Psychiatry, 127,* 247-256. doi:10.1192/bjp.127.3.247

Barraclough, B., & Harris, E.C. (2002). Suicide preceded by murder: the epidemiology of homicide–suicide in England and Wales 1988–92. *Psychological Medicine, 32,* 577-584. doi:10.1017/S0033291702005500

Barraclough, B., Holding, T., & Fayers, P. (1976). Influence of coroners' officers and pathologists on suicide verdicts. *The British Journal of Psychiatry, 128,* 471-474.

Beautrais, A.L. (2002). A case control study of suicide and attempted suicide in older adults. *Suicide and Life-Threatening Behaviour, 32,* 1-9. doi: 10.1521/suli.32.1.1.22184

Bennewith, O., Hawton, K., Simkin, S., Sutton, L., Navneet, K., Turnball, P., & Gunnell, D. (2005). The Usefulness of Coroner's Data on Suicides for Providing Information Relevant to Prevention. *Suicide and Life Threatening Behaviour, 35,* 607-614. doi: 10.1521/suli.2005.35.6.607

Biffl, E. (1996). Psychological autopsies: Do they belong in the courtroom? *American Journal of Criminal Law, 24,* 123-146.

Bolger, N., Downey, G., Walker, E., & Steininger, P. (1989). The onset of suicidal ideation in childhood and adolescence. *Journal of Youth and Adolescence, 18,* 175-190. doi: 10.1007/BF02138799

Brent, D.A., Perper, J.A., Mortiz, G., & Allman, C. (1993). Psychiatric sequelae to the loss of an adolescent peer to suicide. *Journal of the American Academy of Child and Adolescent Psychiatry, 32,* 509-517. doi: 10.1097/00004583-199305000-00004

Breiman, L., Friedman, J.H., Olshen, R.A., & Stone, C.J. (1984). *Classification and Regression Trees.* Belmont: Wadsworth.

Brieding, M.J., & Wiersema, B. (2006). Variability of undetermined manner of death classification in the US. *Injury Prevention, 12,* ii49-ii54. doi:10.1136/ip.2006.012591

Briollais. L., Wang, Y., Rajendram, I., Onay, V., Shi, E., Knight, J., & Ozcelik, H. (2007). Methodological issues in detecting gene-gene interactions in breast cancer susceptibility: a population-based study in Ontario. *BMC Medicine, 5,* 22. doi: 10.1186/1741-7015-5-22

Briginshaw v Briginshaw, HCA, 60 CLR 336 (1938).

Brooke, E.M., & Atkinson, M. (1974). Ascertainment of deaths from Suicide. In E.M. Brooke (Ed.). *Suicide and attempted suicide* (pp.15-68). Retrieved from http://whqlibdoc.who.int/php/WHO_PHP_58.pdf

Burrows, S., & Laflamme, L. (2007). Determination of Suicide in South Africa: Medical Practitioner Perspectives. *Archives of Suicide Research, 11,* 281-290. doi: 10.1080/13811110701403981

Burvill, P.W. (1995). Suicide in the Multiethnic Elderly Population of Australia, 1979-1990. *International Psychogeriatrics, 7,* 319-333. doi:10.1017/S1041610295002079

Burvill, P.W., Woodings, T.L., Stenhouse, N.S., & McCall, M.G. (1982). Suicide during 1961-70 of migrants in Australia. *Psychological Medicine, 12,* 295-308. doi: 10.1017/S0033291700046638

Byard, R.W., & Botterill, P. (1998). Autoerotic Asphyxial Death – Accident or Suicide? *The American Journal of Forensic Medicine, 19*, 377-380.

Calhoun, L.G., & Allen, B.G. (1991). Social reactions to the survivor of suicide in the family: A review of the literature. *Omega: The Journal of Death and Dying, 23,* 95-107.

Calhoun, L.G., Selby, J.W., & Faulstich, M.F. (1980). Reactions to the Parents of the Child Suicide: A study of social impressions. *Journal of Consulting and Clinical Psychology, 48,* 535-536. doi:10.1037/0022-006X.48.4.535

Calhoun, L.G., Selby, J.W., & Faulstich, M.F. (1982). The aftermath of childhood suicide: Influences of the perception of the parent. *Journal of Community Psychology, 10,* 250-254. doi:10.1002/1520-6629(198207)10:3<250::AID-JCOP2290100309>3.0.CO;2-H

Camdeviren, H. A., Yazici, A. C., Akkus, Z., Bugdayci, R., & Sungur, M. A. (2007). Comparison of Logistic Regression Model and Classification Tree: An Application to Postpartum Depression Data. *Expert Systems with Applications*, *32*, 987–994. doi:10.1016/j.eswa.2006.02.022

Cantor, C., McTaggart, P., & De Leo, D. (2001). Misclassification of suicide – the contribution of opiates. *Psychopathology*, *34*, 140-146. doi: 10.1159/000049297

Cantor, C., & Neulinger, K. (2000). The epidemiology of suicide and attempted suicide among young Australians. *Australian and New Zealand Journal of Psychiatry 2000, 34,* 370–387. doi:10.1046/j.1440-1614.2000.00756.x

Carlson, K.A., & Russo, J.E. (2001). Biased Interpretation of Evidence by Mock Jurors. *Journal of Experimental Psychology: Applied, 7*, 91-103. doi: 10.1037/1076-898X.7.2.91

Carpenter, B., Barnes, M., Adkins, G., Naylor, C., Tait., G., & Begum, N. (2008). The coronial system in Queensland: The effects of new legislation on decision-making. *Journal of Law and Medicine, 16,* 458- 465.

Carpenter, B.J., Barnes, M., Naylor, C., Adkins, G., & White, B. (2006). Issues surrounding a reduction in the use of internal autopsy in the Coronial system. *Journal of Law and Medicine, 14,* 199-208.

Carpenter, B.J., & Tait, G. (2010). The autopsy imperative: medicine, law, and the coronial investigation. *The Journal of Medical Humanities, 31,* 205-221. doi:10.1007/s10912-010-9111-7

Carpenter, B.J., Tait, G., Barnes, M., Adkins, B. A., Naylor, C., & Begum, N. (2009). Increasing the information available to Coroners: the effect on autopsy decision making. *Medicine, Science and the Law, 49,* 101-109. doi:10.1258/rsmmsl.49.2.101

Chang, S., Sterne, J.A.C., Lu, T., & Gunnell, D. (2010). 'Hidden' suicides amongst deaths certified as undetermined intent, accident by pesticide poisoning and accident by suffocation in Taiwan. *Social Psychiatry and Psychiatric Epidemiology, 45,* 143-152.

Cheng, A.T.A., Chen, T.H.H., Chen, C., & Jenkins, R. (2000). Psychosocial and psychiatric risk factors for suicide. *British Journal of Psychiatry, 177,* 360-365.

Clark, M.A., Feczko, J.D., Hawley. D.A., Pless, J.E., Tate, L.R., & Fardal, P.M. (1993). Asphyxial deaths due to hanging in children. *Journal of Forensic Sciences, 38,* 344-352. doi:10.1520/JFS13414J

Cohen-Sandler, R., Berman, M.A., & King, R.A. (1982). Life Stress and Symptomatology: Determinants of Suicidal Behaviour in Children. *Journal of*

the American Academy of Child Psychiatry, 21, 178-186. doi:10.1016/S0002-7138(09)60917-1

Colwell, L.H. (2005). Cognitive heuristics in the context of legal decision making. *American Journal of Forensic Psychology, 23,* 17-41.

Connolly, J.F., Cullen, A., & McTigue, O. (1995). Single Road Traffic Deaths: Accident or Suicide? *Crisis: The Journal of Crisis Intervention and Suicide, 16,* 85-89.

Conwell, Y., Duberstein, P.R., & Caine, E.D. (2002). Risk Factors for Suicide in Later Life. *Journal of Biological Psychiatry, 52,* 193-204. doi:10.1016/S0006-3223(02)01347-1

Cook, M.B., & Smallman, H.S. (2008). Human Factors of the Confirmation Bias in Intelligence Analysis: Decision Support from Graphical Evidence Landscapes. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 50,* 745-754. doi: 10.1518/001872008X354183

Cooke, C.T., Cadden, G.A., & Margolius, K.A. (1995). Death by hanging in Western Australia. *Pathology, 27,* 268-72. doi: 10.1080/00313029500169093

Cooper, P.N., & Milroy, C.M. (1995). The coroner's system and under-reporting of suicide. *Medicine, Science and Law, 35,* 319-26.

Crepeau-Hobson, F. (2010). The psychological autopsy and determination of child suicides: A survey of medical examiners. *Archives of Suicide Research, 14,* 24-34. doi: 10.1080/13811110903479011

Dawes, R.M., Faust, D., & Meehl, P.E. (1989). Clinical versus actuarial judgement. *Science, 243,* 1668-1674. doi: 10.1126/science.2648573

De Jong, J., & Hanzlick, R. (2000). Level of agreement between opinions of medical examiners investigators and forensic pathologist medical examiners regarding

the manner of death. *American Journal of Forensic Medicine and Pathology, 21,* 11-20.

De Leo. D., Burgis, S., Bertolote, J.M., Kerkhof, A.J.F.M., & Bille-Brahe, U (2006). Definitions of Suicidal Behaviour: Lessons learned from the WHO/EURO Multicentre Study. *Crises, 27,* 4-15. doi: 10.1027/0227-5910.27.1.4

De Leo, D., Dudley, M.J., Aebersold, C.J., Mendoza, J.A., Barnes, M.A., Harrison, J.E., & Ranson, D.L. (2010). Achieving standardised reporting of suicide in Australia: rationale and program for change. *The Medical Journal of Australia, 192,* 452-456.

De Leo, D., Milner, A., & Xiangdong, W. (2009). Suicidal Behaviour in the Western Pacific Region: Characteristics and Trends. *Suicide and Life-Threatening Behaviour, 39,* 72-81. doi: 10.1521/suli.2009.39.1.72

Ding, Y., & Simonoff, J.S. (2010). An Investigation of Missing Data Methods for Classification Trees Applied to Binary Response Data. *Journal of Machine Learning Research, 11,* 131-170.

Domino, G., & Leenaars, A.A. (1995). Attitudes toward suicide among English-speaking urban Canadians. *Death Studies, 19,* 489-500. doi: 10.1080/07481189508253395

Donaldson, A.E., Larsen, G.Y., Fullerton-Gleason, L., & Olsen, L.M. (2006). Classifying undetermined poisoning deaths. *Injury Prevention, 12,* 338-343. doi: 10.1136/ip.2005.011171

Donoghue, E.R., & Lifschultz, B.D. (1989). Discussion of 'Operational Criteria for the Determination of Suicide' (Letter to the Editor). *Journal of Forensic Sciences, 34,* 1056-1058.

Dunn. R.G., & Morish-Vidners, D. (1987). The psychological and social experience of suicide survivors. *Omega: The Journal of Death and Dying, 18,* 175-215.

Ebert, B.W. (1987). Guide to Conducting a Psychological Autopsy. *Professional Psychology: Research and Practice, 18,* 52-56.

Eldridge D. (2008). Injury among young Australians. AIHW bulletin series no. 60. Canberra: Australian Institute of Health and Welfare, 30. (AIHW Cat. No. AUS 102.). Retrieved at http://www.aihw.gov.au/publications/aus/bulletin60/bulletin60.pdf

Farberow, F.L., MacKinnon, N.L., & Nelson, D.R. (1977). Suicide: Who's counting? *Public Health Reports, 92,* 223-232.

Farmer, R., & Rohde, J. (1980). Effect of availability and acceptability of lethal instruments on suicide mortality: An analysis of some international data. *Acta Psychiatrica Scandinavica, 62,* 436-445. doi: 10.1111/j.1600-0447.1980.tb00632.x

Field, A. (2005). *Discovering Statistics Using SPSS.* London: Sage Publications.

Freckelton, I. (2005). The Myers Oration 2005: Untimely Death, Law and Suicidality. *Psychiatry, Psychology and Law, 12,* 265-278. doi: 10.1375/pplt.12.2.265

Freckelton, I. (2007). Death investigation, the coroner and therapeutic jurisprudence. *Journal of Law and Medicine, 15,* 242-53.

Freckelton, I., & Ranson, D. (2006). *Death Investigation and the Coroner's Inquest.* Oxford University Press: Melbourne.

Garb, H.N. (1994). Toward a second generation of statistical prediction rules in psychodiagnosis and personality assessment. *Computers in Human Behaviour, 11,* 313-324. doi: 10.1016/0747-5632(94)90063-9

Garfinkle, B.D., Froese, A., & Hood, J. (1982). Suicide attempts in children and adolescents. *The American Journal of Psychiatry, 139,* 1257-1261.

Gau, S.S.F., & Cheng, A.T.A. (2004). Mental illness and accidental death. *British Journal of Psychiatry, 185,* 422-428.

Gilbert, D.T. Krull, B.W., & Pelham, D.S. (1988). On Cognitive Busyness: When Person Perceivers Meet Persons Perceived. *Journal of Personality and Social Psychology, 54,* 733-740.

Goodin, J., & Hanzlick, R. (1997). Mind Your Manners: Part II: General Results From the National Association of Medical Examiners Manner of Death Questionnaire, 1995. *American Journal of Forensic Medical Pathology, 18,* 224-227.

Goren, S., Gurkan, F., Tirasci, Y., & Ozen, S. (2003). Suicide in children and adolescents at a province in Turkey. *American Journal of Forensic Medicine & Pathology, 24,* 214-217.

Gosney, H., & Hawton, K. (2007). Inquest verdicts: Youth suicides lost. *Psychiatric Bulletin, 31,* 203-205. doi: 10.1192/pb.bp.105.007773

Greene, D.B. (1994). Childhood suicide and myths surrounding it. *Social Work, 39,* 230-232.

Groholt, B., & Ekeberg, O. (2003). Suicide in young people under 15 years: Problems of classification. *Nordic Journal of Psychiatry, 57,* 411-417. doi: 10.1080/08039480310003425

Grove, W.M., Zald, D.H., Lebow, B.E., Snitz. B.E., & Nelson, C. (2000). Clinical Versus Mechanical Prediction: A Meta-Analysis. *Psychological Assessment, 12,* 19-30. doi: 10.1037/1040-3590.12.1.19

Hallenstein, H. (1990, July). *Suicide: the coroner as catalyst.* Paper presented at Preventing Youth Suicide conference, Australian Institute of Criminology (AIC), Adelaide. Retrieved at

http://www.aic.gov.au/publications/previous%20series/proceedings/1-27/~/media/publications/proceedings/13/hallenstein.ashx

Hanzlick, R., & Goodin, J. (1997). Mind Your Manners: Part III: General Results From the National Association of Medical Examiners Manner of Death Questionnaire, 1995. *American Journal of Forensic Medical Pathology, 18,* 228-245.

Harris, E.C., & Barraclough, B. (1997). Suicide as an outcome for mental disorders. A meta-analysis. *British Journal of Psychiatry, 170,* 205-228.

Hiroeh, U., Appleby, L., Mortensen, P. B., & Dunn, G. (2001). Death by homicide, suicide, and other unnatural causes in people with mental illness: A population-based study. *Lancet, 358,* 2110-2112. doi: 10.1016/S0140-6736(01)07216-6

Hiss, J., Rosenberg, S.B., & Adelson, L. (1985). "Swinging in the park": An investigation of an autoerotic death. *The American Journal of Forensic Medicine and Pathology, 6,* 250-255.

Ho, T.P., Yip, P.S.F., Chiu, C.W.F., & Halliday, P. (1998). Suicide notes: what do they tell us? *Acta Psychiatrica Scandinavica, 98,* 467-473.

Hoberman, H.M., & Garfinkel, B.D. (1988). Completed suicide in children and adolescents. *American Academy of Child Psychiatry, 27,* 689-695.

Holding, T.A., & Barraclough, B.M. (1975). Psychiatric morbidity in a sample of a London coroner's open verdicts. *British Journal of Psychiatry, 127,* 133-143.

Holding, T.A., & Barraclough, B.M. (1978). Undetermined deaths – Suicide or Accident? *British Journal of Psychiatry, 133,* 542-549.

Holt, R.R. (1970). Yet another look at clinical and statistical prediction. Or, is clinical psychology worthwhile? *American Psychologist. 25,* 337-349. doi: 10.1037/h0029481

Hunsaker, D.M., & Thorne, L.B. (2002). Suicide by Blunt Force Trauma. *The American Journal of Forensic Medicine and Pathology, 23,* 355-359.

Huusko, R., & Hirvonen, J. (1988). The Problem of Determining the Manner of Death as Suicide or Accident in Borderline Cases. *Zeitschrift fur Rechtsmedizin, 100,* 207-213. doi: 10.1007/BF00200761

Jacobson, S., Bagley, C., & Rehin, A. (1971). Clinical and social variables which differentiate suicide, open and accident verdicts. *Medical Journal Australia, 23,* 840-848. doi: 10.1017/S0033291700015853

Jarvis, G.K., Boldt, M., & Butt, J. (1991). Medical Examiners and Manner of Death. *Suicide and Life-Threatening Behaviour, 21,* 115-133.

Jobes, D.A., Berman, A.L., & Josselson, A.R. (1986). The Impact of Psychological Autopsies on Medical Examiners' Determination of Manner of Death. *Journal of Forensic Sciences, 31,* 177-189. doi: 10.1520/JFS11870J

Jobes, D.A., Berman, A.L., & Josselson, A.R. (1987). Improving the Validity and Reliability of Medical-Legal Certifications of Suicide. *Suicide and Life-Threatening Behaviour, 17,* 310-325.

Jobes, D.A., Casey, J.O., Berman, A.L., & Wright, D.G. (1991). Empirical Criteria for the Determination of Suicide Manner of Death. *Journal of Forensic Sciences, 36,* 244-256.

Joiner, T.E., Walker, R.L., Rudd, M.D., & Jobes, D.A. (1999). Scientizing and Routinizing the Assessment of Suicidality in Outpatient Practice. *Professional Psychology: Research and Practice, 30,* 447-453.

Jordan, J.R. (2001). Is suicide bereavement different? A reassessment of the literature. *Suicide & Life Threatening Behaviour, 31,* 91-102.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgment under uncertainty: Heuristics and biases.* Cambridge: Cambridge University Press.

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological Review, 80,* 237-251.

Kassin, S. M., Goldstein, C. C., & Savitsky, K. (2003). Behavioral confirmation in the interrogation room: on the dangers of presuming guilt. *Law and Human Behavior, 27,* 187-203. doi: 10.1023/A:1022599230598

Khan, M.M. (2005). Suicide prevention and developing countries. *Journal of the Royal Society of Medicine, 98,* 459-463. doi: 10.1258/jrsm.98.10.459

Kelly, S., & Bunting, J. (1998). Trends in suicide in England and Wales, 1982-96. *Population Trends, 92,* 29-42.

Klayman, J., & Ha, Y. (1987). Confirmation, Disconfirmation, and Information in Hypotheses Testing. *Psychological Review, 94,* 211-228.

Kliewer, E. (1991). Immigrant suicide in Australia, Canada, England and Wales, and the United States. *Journal of the Australian Population Association, 8,* 111-128. doi: 10.1007/BF03029440

Knoll, J.L. (2008). The Psychological Autopsy, Part I: Applications and Methods. *Journal of Psychiatric Practice, 14,* 393-397. doi: 10.1097/01.pra.0000341894.35877.1b

Knoll, J.L. (2009). The Psychological Autopsy, part II: Toward a Standardized Protocol. *Journal of Psychiatric Practice, 15,* 52-59. doi: 10.1097/01.pra.0000344920.36157.95

Koehler, S.A. (2007). The Role of Suicide Notes in Death Investigation. *Journal of Forensic Nursing, 3,* 87-89. doi: 10.1111/j.1939-3938.2007.tb00109.x

Lacks, R.D., Westveer, A.E., Dibble, A., & Clemente, J. (2008). Equivocal Death Investigation: Case Study Analyses. *Victims & Offenders, 3,* 150-164. doi: 10.1080/15564880801938292

Lester, D. (1992-1993). The stigma against dying and suicidal patients: A replication of Richard Kalish's study twenty-five years later. *Omega: Journal of Death and Dying, 26,* 71-75.

Lester, D., & Fleck, J. (2010). What is suicide? Will suicidologists ever agree? *Psychological Reports, 106,* 189-192.

Lester, D., & Walker, R.L. (2006). The stigma for attempting suicide and the loss to suicide prevention efforts. *Crisis, 27,* 147-148.

Lindqvist, P., & Gustafsson, L. (2002). Suicide classification – clues and their use. A study of 122 cases of suicide and undetermined manner of death. *Forensic Science International, 128,* 136-140. doi: 10.1016/S0379-0738(02)00188-3

Linsley, K. R., Schapira, K., & Kelly, T.P. (2001). Open verdict vs suicide – importance to research. *British Journal of Psychiatry, 178,* 465-468.

Litman, R.E., Curphey, T., Shneidman, E.S., Farberow N.L., & Tabachnick, N. (1963). Investigations of Equivocal Suicides. *The Journal of the American Medical Association, 184,* 924-929.

Lopez, S.R. (1989). Patient variable biases in clinical judgment: conceptual overview and methodological considerations. *Psychology Bulletin, 106,* 184-203. doi: 10.1037/0033-2909.106.2.184

Luke, J.L. (1967). Asphyxial deaths by hanging in New York City, 1964-1965. *Journal of Forensic Sciences, 12,* 359-369.

Lunetta, P., Smith, G.S., Penttila, A., & Sajantila, A. (2003). Undetermined drowning. *Medicine, Science and the Law, 43,* 207-214. doi: 10.1258/rsmmsl.43.3.207

Madge, N., & Harvey, J.G. (1999). Suicide among the young: the size of the problem. *Journal of Adolescence, 22,* 145-155. doi: 10.1006/jado.1998.0207

Mangall, J., & Yurkovich, E. (2008). A literature review of deliberate self-harm. *Perspective Psychiatric Care, 44*, 175-184. doi: 10.1111/j.1744-6163.2008.00172.x

Marchese, M.C. (1992). Clinical versus actuarial prediction: A review of the literature. *Perceptual and Motor Skills, 75*, 583-594. doi:

Marttunen, M.J., Aro. H.M., & Lonnqvist, J.K. (1993). Adolescence and suicide: A review of psychological autopsy studies. *European Child & Adolescent Psychiatry, 2,* 10-18. doi: 10.1007/BF02098826

Massello III., W. (1986). The Proof in Law of Suicide. *Journal of Forensic Sciences, 31,* 1000-1008.

Matshes, E.W., & Lew, E.O. (2010). Homicide by Unspecified Means. *The American Journal of Forensic Medicine and Pathology, 31,* 174-177. doi: 10.1097/PAF.0b013e3181df62da

Matter, D.E., & Matter, R.M. (1984). Suicide among elementary school children: A serious concern for counsellors. *Elementary School Guidance & Counselling, 18,* 260-267.

McCarthy, P.D., & Walsh, D. (1975). Suicide in Dublin: I. The under-reporting of suicide and the consequences for national statistics. *British Journal of Psychiatry, 126*, 301-308.

Meehl, P.E. (1954). *Clinical vs. Statistical prediction: A theoretical analysis and a review of the evidence.* Minneapolis: University of Minnesota Press.

Meehl, P.E. (1960). The cognitive activity of the clinician. *American Psychologist, 15,* 19-27. doi: 10.1037/h0041744

Milovanovich, C. (2006, March). *The role of the coroner and the coroners court.* Paper presented at the State Legal Studies Teacher's Conference, Parramatta. Retrieved at

http://www.lsa.net.au/conf2006/THE%20ROLE%20OF%20THE%20CORONER%20AND%20CORONERS%20COURT.pdf

Mishara, B. (1999). Conceptions of death and suicide in children ages 6–12 and their implications for suicide prevention. *Suicide and Life-Threatening Behaviour, 29*,105–118.

Morild, I. (1994). Traffic deaths in Western Norway. A study from the county of Hordaland, 1986-1990. *Forensic Science International, 64*, 9-20. doi: 10.1016/0379-0738(94)90238-0

Moscicki, E.K. (1995). Epidemiology of suicidal behavior. *Suicide and Life Threatening Behaviour, 25,* 22-35.

Murray, D., & de Leo, D. (2007). Suicidal Behaviour by Motor Vehicle Collision. *Traffic Injury Prevention, 8,* 244-247. doi: 10.1080/15389580701329351

Neeleman, J., Halpen, D., Leon, D., & Lewis, G. (1997). Tolerance of suicide, religion and suicide rates: an ecological and individual study in 19 Western countries. *Psychological Medicine, 27,* 1165-1171. doi: 10.1017/S0033291797005357

Neeleman, J., & Wessely, S. (1997). Changes in classification of suicide in England and Wales: time trends and associations with coroners' professional backgrounds. *Psychological Medicine, 27,* 467-472. doi: 10.1017/S0033291796004631

Nelson, R.E., & Crawford, B. (1990). Suicide Among elementary school-aged children. *Elementary School Guidance and Counselling, 25,* 123-128.

Nickerson, R.S. (1998). Confirmation Bias: A Ubiquitous Phenomenon in Many Guises. *Review of General Psychology, 2,* 175-220.

Nisbett, R., & Ross, L. (1980). Human inference: strategies and shortcomings of social judgment. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Normand, C.L., & Mishara, B. (1992). The Development of the Concept of Suicide in Children. *Omega: Journal of Death and Dying, 25,* 183-203.

O'Carroll, P.W. (1989). A consideration of the validity and reliability of suicide mortality data. *Suicide and Life-Threatening Behaviour, 19,* 1-16.

O'Donnell, I., & Farmer, R. (1995). The limitations of official suicide statistics. *British Journal of Psychiatry, 166,* 458-461.

O'Donnell, I., Farmer, R., & Catalàn, J. (1993). Suicide notes. *British Journal of Psychiatry, 163,* 45–48.

Ohberg, A., & Lonnqvist, J. (1998). Suicide hidden among undetermined deaths. *Acta Psychiatrica Scandinavica, 98,* 214-218.

Pamer, C., Serpi, T., & Finkelstein, J. (2008). Analysis of Maryland Poisoning Deaths Using Classifcation and Regression Tree (CART) Analysis. *American Medical Information Association (AMIA) Symposium Proceedings,* 550-554.

Parai, J.L., Krieger, N., Tomlinson, G., & Adlaf, E.M. (2006). The validity of the Certification of Manner of Death by Ontario Coroners. *Annals of Epidemiology, 16,* 805-811. doi: 10.1016/j.annepidem.2006.01.006

Paulson, M.J., Stone, D., & Sposto, R. (1978). Suicide potential and behaviour in children ages 4 to 12. *Suicide and Life Threatening Behaviour, 8,* 225-242.

Pearson, V. (1995). Goods on Which One Loses: Women and Mental Health in China. *Social Science and Medicine, 41,* 1159–1173. doi: 10.1016/0277-9536(94)00424-R

Peck, D.L., & Warner, K. (1995). Accident or Suicide? Single-vehicle car accidents and the intent hypotheses. *Adolescence, 30,* 463-472. http://dx.doi.org/10.1037/0022-3514.51.2.242

Pennington, N., & Hastie, R. (1986). Evidence evaluation in complex decision making. *Journal of Personality and Social Psychology, 51,* 242-258. doi: 10.1037/0022-3514.51.2.242

Pennington, N., & Hastie, R. (1988). Explanation-based decision making: The effects of memory structure on judgment. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14,* 521-533.

Pennington, N., & Hastie, R. (1992). Explaining the evidence: Tests of the story model for juror decision making. *Journal of Personality and Social Psychology, 62,* 189-206.

Perdekamp, M.G., Pollak, S., & Thierauf, A. (2010). Medicolegal evaluation of suicidal deaths exemplified by the situation in Germany. *Forensic Science, Medicine, and Pathology, 6,* 58-70. doi: 10.1007/s12024-009-9120-x

Perper, J.A., Juste, G.M., Schueler, H.E., Motte, R.W., & Cina, S.J. (2006). Suggested guidelines for the management of high-profile fatality cases. *Archives of Pathology & Laboratory Medicine Online, 132,* 1630-1634.

Pfeffer, C. R. (1994). Developmental issues in child and adolescent suicide: A discussion. *New Directions for Child Development, 64,* 109–114. doi:10.1002/cd.23219946409

Pfeffer, C.R., Lipkins, R., Plutchik, R., & Mizruchi, M.S. (1988). Normal children at risk for suicidal behaviour: A two year follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry, 27,* 34-41. doi:10.1097/00004583-198801000-00006

Phillips, D. (1977). Motor Vehicle Fatalities Increase Just After Publicized Suicide Stories. *Science, 196,* 1464-1466. doi: 10.1126/science.867044

Phillips, M.R., Liu, H., & Zhang, Y. (1999). Suicide and Social Change in China. *Culture, Medicine and Psychiatry 23,* 25–50. doi:10.1023/A:1005462530658

Platt, S., Beckett, S., & Kreitman, N. (1988). Social construction or causal ascription: distinguishing suicide from undetermined deaths. *Social Psychiatry and Psychiatric Epidemiology, 23,* 217-221. doi:10.1007/BF01787820

Queensland Births, Deaths and Marriages Registration Act, 6, s41 (2003). Retrieved at www.legislation.qld.gov.au/legisltn/acts/2003/03ac031.pdf

R v Gilfoyle, EWCA Crim 81 (2001). Retrieved at http://www.bailii.org/ew/cases/EWCA/Crim/2000/81.html

Range, L.M., & Calhoun, L.G. (1990). Responses following suicide and other types of death: the perspective of the bereaved. *Omega: The Journal of Death and Dying, 21,* 311-320.

Ritter, K., Chaudhry, H.R., Idemudia, E., Karakula, H., Okribelashvili, N., Rudaleviciene, P., & Stompe, T. (2008). Suicide motives and culture: Degree of modernization, response behavior and acceptance. *World Cultural Psychiatry Research Review, 4,* 69-76.

Roberts, I.S.D., Gorodkin, L.M., & Benbow, E.W. (2000). What is a natural cause of death? A survey of how coroners in England and Wales approach borderline cases. *Journal of Clinical Psychiatry, 53,* 367-373. doi: 10.1136/jcp.53.5.367

Robertson, R., & Crawley, T. (2009). Determining manner of death: Statistical modelling of coronial decisions. *Journal of Law and Medicine, 17,* 224-234.

Rockett, I.R.H., Samora, J.B., & Coben, J.H. (2006). The black–white suicide paradox: Possible effects of misclassification. *Social Science and Medicine, 63,* 2165-2175. doi: 10.1016/j.socscimed.2006.05.017

Rorsman, B., Hagnell, O., & Lanke, J. (1982). Violent death and mental disorders in the Lundby Study. Accidents and suicides in a total population during a 25-year period. *Neuropsychobiology, 8,* 233-240. doi: 10.1159/000117904

Rosenberg, M.L., Davidson, L.E., Smith, J.C., Berman, A.L., Buzbee, H., Gantner, G., Gay, G.A., Moore-Lewis, B., Mills, D.H., Murray, D., O'Carroll, P.W., & Jobes, D. (1988). Operational Criteria for the Determination of Suicide. *Journal of Forensic Sciences, 33,* 1445-1456.

Ross, O., & Kreitman, N. (1975). A further investigation of differences in the suicide rates of England and Wales and of Scotland. *British Journal of Psychiatry, 127,* 575-582. doi: 10.1192/bjp.127.6.575

Rubenowitz, E.,Waern, M., Wilhelmson, K., & Allebeck, P. (2001). Life events and psychosocial factors in elderly suicides – a case-control study. *Psychological Medicine, 31,* 1193-1202. doi: 10.1017/S0033291701004457

Rudd, M.D. (1997). What's in a name? *Suicide and Life-Threatening Behaviour, 27,* 326-327.

Rudestam, K.E., & Imbrol, D.I. (1983). Societal reactions to a child's death by suicide. *Journal of Consulting and Clinical Psychology, 51,* 461-462. doi: 10.1037/0022-006X.51.3.461

Ruschena, D., Mullen, P. E., Burgess, P., Cordner, S.M., Barry-Walsh, J., Drummer, O.H., Palmer, S., Browne, C., & Wallace, C. (1998). Sudden death in psychiatric patients. *British Journal of Psychiatry, 172,* 331-336.

Sainsbury P., & Barraclough, B. (1968). Differences between Suicide Rates. *Nature, 220,* 1252. doi:10.1038/2201252a0

Salib, E. (1996). Predictors of Coroner's Verdict: a logistic regression model. *Journal of Medicine, Science and Law, 36,* 237-241.

Salib, E. (1997). Coroner's Verdicts in the Elderly: A Suicide or an Open Verdict? *International Journal of Geriatric Psychiatry, 12,* 481-483. doi: 10.1002/(SICI)1099-1166(199704)12:4<481::AID-GPS514>3.0.CO;2-F

Salib, E., & Agnew, N. (2005). Suicide and undetermined deaths by drowning. *International Journal of Psychiatry in Clinical Practice, 9,* 107-115. doi:10.1080/13651500510018257

Salib, E., Cawley, S., & Healy, R. (2002). The significance of suicide notes in the elderly. *Aging and Mental Health, 6,* 186-190. doi:10.1080/13607860220126745

Sauvageau, A. (2009). True and simulated homicidal hangings: a six year retrospective study. *Medicine, Science and the Law, 49,* 283-290. doi:10.1258/rsmmsl.49.4.283

Sawyer, J. (1966). Measurement and prediction, clinical and statistical. *Psychological Bulletin, 66,* 178-200. doi: 10.1037/h0023624

Schmidt, P., Muller, R., Dettmeyer, R., & Madea, B. (2002). Suicide in children, adolescents and young adults, *127,* 161-167. doi: 10.1016/S0379-0738(02)00095-6

Schmidt, C.W., Shaffer, J.W., Zlotowitz, H.I., & Fisher, R.S. (1977). Suicide by vehicular crash. *American Journal of Psychiatry, 134,* 175-178.

Scott, C.L., Swartz, E., & Warburton, K. (2006). The Psychological Autopsy: Solving the Mysteries of Death. *Psychiatric Clinics of North America, 29,* 805-822.

Shai, D. (1994). Problems of Accuracy in Official Statistics on Drug-Related Deaths. *The International Journal of the Addictions, 29,* 1801-11. doi:10.3109/10826089409128258

Shaw, D., Fernandes, J.R., & Rao, C. (2005). Suicide in Children and Adolescents: A 10-Year Retrospective Review. *The American Journal of Forensic Medicine and Pathology, 26,* 309-315.

Shneidman, E.S. (1981). The Psychological Autopsy. *Suicide and Life Threatening Behaviour, 11,* 325-340.

Silverman, M.M. (2006). The language of suicidology. *Suicide and Life-Threatening Behaviour, 36,* 519-532.

Sines, J.O. (1971). Actuarial versus clinical prediction in psychopathology. *British Journal of Psychiatry, 116,* 129-144. doi: 10.1192/bjp.116.531.129

Singh, V.D., & Lathrop, S.L. (2008). Youth Suicide in New Mexico: A 26-Year Retrospective Review. *Journal of Forensic Sciences, 53,* 703-708. doi: 10.1111/j.1556-4029.2008.00721.x

Smithey, M., & Ramirez, I.L. (2004). Suspicion of sudden infant death syndrome & injuries to infants: the effects of type of death certifier, training, and economics. *Deviant Behaviour, 25,* 465-482. doi: 10.1080/01639620490450678

Snider, J., Hane, S., & Berman, A. (2006). Standardizing the psychological autopsy: Addressing the Daubert standard. *Suicide and Life-Threatening Behaviour, 36,* 511–518. doi: 10.1521/suli.2006.36.5.511

Sorenson, S.B., Shen, H., & Kraus, J.F. (1997a). Undetermined Manner of Death: A comparison with unintentional injury, suicide, and homicide death. *Evaluation Review, 21,* 43-57. doi: 10.1177/0193841X9702100103

Sorenson, S.B., Shen. H., & Kraus, J.F. (1997b). Coroner-Reviewed Infant and Toddler Deaths Many "Undetermineds" Resemble Homicides. *Evaluation Review, 21,* 58-76. doi: 10.1177/0193841X9702100104

South Australian Coroners Act, 5, s29 (2003). Retrieved at http://www.legislation.sa.gov.au/LZ/C/A/CORONERS%20ACT%202003/CURRENT/2003.33.UN.PDF

Spellman, A., & Heyne, B. (1989). Suicide? Accident? Predictable? Avoidable? The psychological autopsy in jail suicides. *Psychiatric Quarterly, 60,* 173-183. doi:10.1007/BF01064943

Stack, S., & Wasserman, I. (2005). Race and method of suicide: culture and opportunity. *Archives of Suicide Research, 9,* 57-68. doi: 10.1080/13811110590512949

Stanistreet, D., Gabbay, M., & Taylor, S. (2004). Are Deaths Due to Drug Use Among Young Men Underestimated in Official Statistics? *Drugs: Education, Prevention and Policy, 11,* 229-242. doi: 10.1080/0968763032000159155

Stanistreet, D., Taylor, S., Jeffrey, V., & Gabbay, M. (2001). Accident or Suicide? Predictors of Coroners' Decisions in Suicide and Accident Verdicts. *Journal of Medicine, Science and Law, 41,* 111-115.

Steadman, H.J., Silver, E., Monahan, J., Appelbaum, P.S., Robbins, P.C., Mulvey, E.P., Grisso, T., Roth, L.H., & Banks, S. (2000). A Classification Tree Approach to the Development of Actuarial Violence Risk Assessment Tools. *Law and Human Behavior, 24,* 83-100. doi: 10.1023/A:1005478820425

Studdert, D.M., & Cordner, S.M. (2010). Impact of coronial investigations on manner and cause of death determinations in Australia, 2000-2007. *The Medical Journal of Australia, 192,* 444-447.

Tanney, B. L. (1992). Mental disorders, psychiatric patients, and suicide. In R.W. Maris, A.L. Berman, J.T. Maltsberger, & R. I. Yufit (Eds.), *Assessment and prediction of suicide* (pp. 277–320). New York: Guilford.

Tatz C. (2005). *Aboriginal suicide is different: a portrait of life and self-destruction.* Canberra: Aboriginal Studies Press.

Timmermans, S. (2005a). Death brokering: constructing culturally appropriate deaths. *Sociology of Health & Illness,* 993-1013. doi: 10.1111/j.1467-9566.2005.00467.x

Timmermans, S. (2005b). Determination and the Professional Authority of Medical Examiners. *American Sociological Review, 70,* 311-333. doi: 10.1177/000312240507000206

Timmermans, S. (2006). *Postmortem: How Medical Examiners Explain Suspicious Deaths.* Chicago: The University of Chicago Press.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185,* 1124–1131. doi: 10.1126/science.185.4157.1124

Van Dongen, C.J. (1993). Social context of post suicide bereavement. *Death studies, 17,* 125-141. doi: 10.1080/07481189308252610

Vanatta, P.R., & Petty, C.S. (1987). Limitations of the forensic external examination in determining the cause and manner of death. *Human Pathology, 18,* 170-174.

Vandamme, J.P., Meskens, N., & Superby, J.F. (2007). Predicting Academic Performance by Data Mining Methods. *Education Economics, 15,* 405 – 419. doi: 10.1080/09645290701409939

Vassilas, C.A., & Morgan, H.G. (1997). Suicide in Avon. Life stress, alcohol misuse and use of services. *The British Journal of Psychiatry, 170,* 453-455.

Victorian Coroners Act, 2, s8, (2008). Retrieved at http://www.coronerscourt.vic.gov.au/wps/wcm/connect/justlib/coroners+court/home/about+us/coroners2+-+coroners+act+2008

Walsh, B., Walsh, D., & Whelan, B. (1975). Suicide in Dublin II: The Influence of Some Social and Medical Factors on Coroners' Verdicts. *British Journal of Psychiatry, 126,* 309-312. doi: 10.1192/bjp.126.4.309

Warshauer, M.E., & Monk, E. (1978). Problems in suicide statistics for whites and blacks. *American Journal of Public Health, 68,* 383–388.

Webb, L., Oyefeso, A., Schifano, F., Cheeta, S., Pollard, M., & Ghodse, A.H. (2003). Cause and manner of death in drug-related fatality: an analysis of drug-related deaths recorded by coroners in England and Wales in 2000. *Drug and Alcohol Dependence, 72,* 67-4. doi: 10.1016/S0376-8716(03)00191-1

Werlang, B.S.G., & Botega, N.J. (2003). A semi-structured interview for psychological autopsy: An inter-rater reliability study. *Suicide and Life-Threatening Behaviour, 33,* 326-330. doi: 10.1521/suli.33.3.326.23217

Wiggins, J.S. (1981). Clinical and statistical prediction: where are we and where do we go from here? *Clinical Psychology Review, 1,* 3-18. doi:10.1016/0272-7358(81)90015-5

Winter, L., & Uleman, J.S. (1984). When are social judgments made? Evidence for the spontaneousness of trait inferences. *Journal of Personality and Social Psychology, 47,* 237-52. doi: 10.1037/0022-3514.47.2.237

Wong, P.W.C., Yeung, A.W.M., & Chan, W.S.C. (2009). Suicide Notes in Hong Kong in 2000. *Death Studies, 33,* 372-381. doi: 10.1080/07481180802705791

World Health Organisation (1998). *Primary prevention of mental, neurological and psychosocial disorders. Suicide.* Geneva: WHO. Retrieved from http://whqlibdoc.who.int/publications/924154516X.pdf

World Health Organisation (2003). *Mental health. Prevention and special programmes. Suicide Rates.* Geneva: WHO. Retrieved from http://www.who.int/mental_health/prevention/suicide/suiciderates/en/

Young, T.J. (1992). Procedures and Problems in Conducting a Psychological Autopsy. *International Journal of Offender Therapy and Comparative Criminology, 36*, 43-52. doi: 10.1177/0306624X9203600105

Appendix

Classification tables of C&RT – B against police hypotheses

Classification table for predicted determinations (based on the suicide C&RT – B) against observed police hypothesis for suicide cases.

Predicted	Observed		Total
	Other determination	Suicide determination	
Other determination	72	15	87
Suicide determination	1	21	22
Total	73	36	109

Specificity: 98.63% (=72/73). Sensitivity: 58.33% (=21/36). Re-substitution cost: 14.68% [=(15+1)/109]. Total accuracy rate: 85.32% [=(72+21)/109].

Classification table for predicted determinations (based on the accidental death C&RT – B) against observed police hypothesis for accidental death cases.

Predicted	Observed		Total
	Other determination	Accident determination	
Other determination	58	8	66
Accident determination	31	12	43
Total	89	20	109

Specificity: 65.17% (=58/89) Sensitivity: 60% (=12/20) Re-substitution cost: 35.78% (=(8+31)/109). Total accuracy rate: 64.22% (=(58+12)/109)